Universal Fire Tube Boiler

Wall Mount

INSTALLATION

START-UP

MAINTENANCE

PARTS

WARRANTY

Models
UFT-80W / 100W / 120W / 140W / 175W / 199W

Heat Exchanger Bears the ASME "H" Stamp

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.

⚠ WARNING

IF THE INFORMATION IN THIS MANUAL IS NOT FOLLOWED EXACTLY, A FIRE OR EXPLOSION MAY RESULT, CAUSING PROPERTY DAMAGE, PERSONAL INJURY, OR LOSS OF LIFE. DO NOT STORE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS OR ANY OTHER BOILER.

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.

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

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

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified 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 technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
   (Never use Water Heater unless it is completely filled with water.)
3. Turn OFF electrical power supply to the Water Heater.
4. Don't try to light the burner by hand.
5. Turn gas shut-off valve clockwise ↷ to "OFF" position. Do not force.
6. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow step "B" above on this label. If you don't smell gas, go to the next step.
7. Turn manual gas shut-off valve countclockwise ↶ to "ON" position.
8. Turn ON electrical power to the appliance.
9. Wait until default temperature (125°F) is displayed. Set desired water temperature. Turn on hot water faucet.
10. Set thermostat to desired setting.
11. 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. Turn manual gas shutoff valve to "OFF".

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 death or serious injury.

⚠ WARNING

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

⚠ CAUTION

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

CAUTION

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

NOTICE	*SAFETY INSTRUCTIONS*
NOTICE is used to address practices not related to personal injury.	**SAFETY INSTRUCTIONS** (or equivalent) signs indicate specific safety related instructions or procedures.

NOTE: Contains additional information important to a procedure.

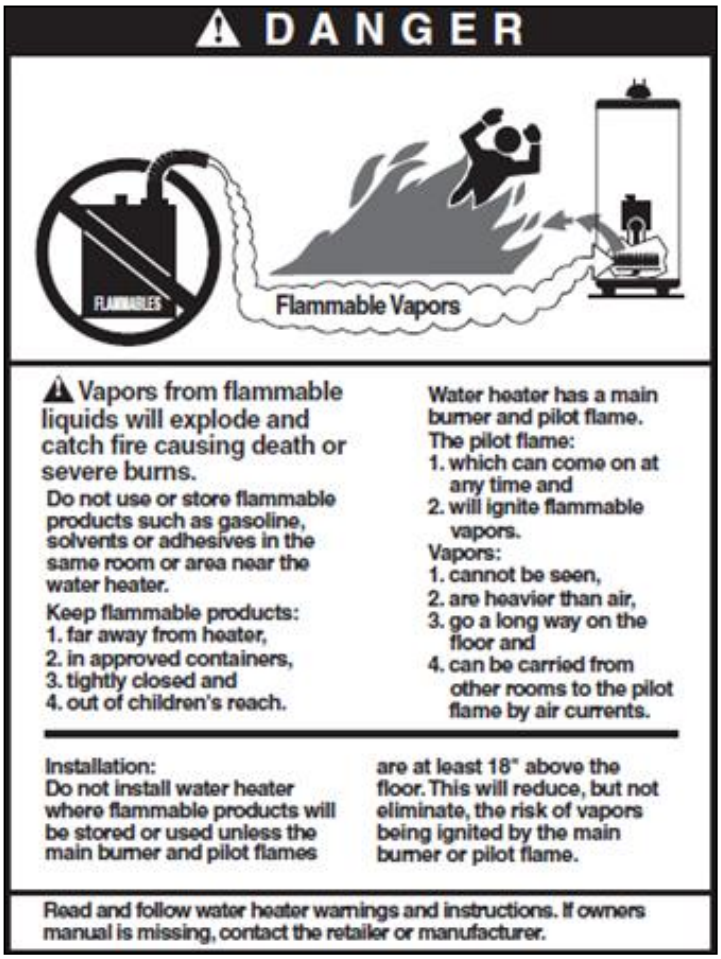
FOREWORD

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 with this system, and additional publications including the National Fuel Gas Code, ANSI Z223.1-2002, 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 Authority Having Jurisdiction 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, Inc. reserves the right to modify product technical specifications and components without prior notice.



FOR THE INSTALLER

⚠ DANGER

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

This boiler must be installed by qualified and licensed personnel. The installer should be guided by the instructions furnished with the boiler, and with local codes and utility company requirements. In the absence of local codes, preference should be given to the National Fuel Gas Code, ANSI Z223.1-2002.

INSTALLATIONS MUST COMPLY WITH:
Authority Having Jurisdiction, 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.

In Canada – CGA No. B149 (latest version), from Canadian Gas Association Laboratories, 55 Scarsdale Road, Don Mills, Ontario, Canada M3B 2R3. Also, Canadian Electrical Code C 22.1, from Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

Code for the installation of Heat Producing Appliances (latest version), from American Insurance Association, 85 John Street, New York, NY 11038.

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

NOTE: The gas manifold and controls met safe lighting and other performance criteria when the boiler underwent tests specified in ANSI Z21.13 – latest edition.

⚠ 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**.

NOTICE

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

- **A modulating combustion system that adjusts firing rate based on heat demand.**
- **Adjustment of appliance set point based on inferred heat load as determined by an outdoor sensor. The outdoor sensor is supplied by HTP, Inc. with this appliance.**
- **This appliance does not include a standing pilot.**
- **This appliance 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 appliance software.**
- **This feature may be over-ridden as described below in specific installations:**
- **The appliance 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.

In accordance with Section 325 (f) (3) of the Energy Policy and Conservation Act, this appliance is equipped with a feature that saves energy by reducing the appliance 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 appliance water temperature as the heating load decreases.**
- **This appliance is not used for space heating.**
- **This appliance is part of a modular or multiple appliance system having a total input of 300,000 BTU/hr or greater.**
- **This appliance is equipped with a tankless coil.**

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.

Certain AHJs, locales, and states will require that commercial boiler installations meet the CSD-1 ASME Code, Section CW-400. To meet this code, HTP, Inc. has integrated a temperature control system into the 926 control provided with this heating boiler. This control system 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 199°F, the boiler is put into a hard lockout and requires manual reset to restart.

Installers should review the regulations of the AHJ, local and state code authorities, and utility companies which pertain to this type of boiler BEFORE performing installation.

TABLE OF CONTENTS

PART 1 – ITEMS SHIPPED WITH THE BOILER

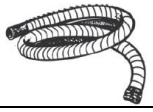
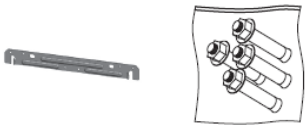
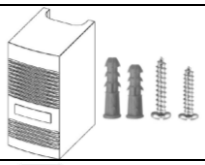
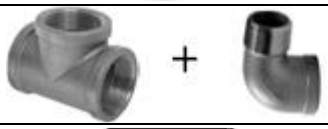
ITEM	DESCRIPTION	QUANTITY
Universal Fire Tube Boiler UFT-W		1
H-2 Form, User, and Installation Manuals		1 Each
Condensate Hose (Part # 7855P-089)		1
Anchors and Wall Mounting Bracket (Part # 7850P-084)		4
Outdoor Sensor with Screws and Anchors (Part # 7855P-084)		1
Spare Parts Kit (Gaskets and O-Rings) (Part # 7855P-383)		1
30 PSI Pressure Relief Valve (Part # 7855P-077)		1
1 ¼" X 1 ¼" X ¾" Tee (steel) (Part # 7855P-313), 3/4" Street Elbow (steel) (Part # 7350P-084)		1
3" CPVC (Part # 7855P-101)		6" Length
Vent Screens (3") (Part # 7855P-085)		2 Screens
LP Conversion Kit (175W / 199W Models Only) (Part #7855P-452)		1

Table 1 – Items Included with the Boiler

OPTIONAL EQUIPMENT

Below is a list of optional equipment available from HTP. These additional options may be purchased through your HTP distributor:

- System Sensor (Part # 7250P-324)
- Indirect Tank Sensor (Part # 7250P-325)
- 2" PVC Concentric Vent Kit (Part # KGAVT0501CVT)
- 3" PVC Concentric Vent Kit (Part # KGAVT0601CVT)
- 2" Stainless Steel Outside Termination Vent Kit (Part # V500)
- 3" Stainless Steel Outside Termination Vent Kit (Part # V1000)
- 4" Stainless Steel Outside Termination Vent Kit (Part # V2000)
- 6" Stainless Steel Outside Termination Vent Kit (Part # V3000)
- 3" Polypro Vent Kit (Part # 8400P-001)
- 3" Polypro Pipe (33' length Part # 8400P-002, 49.5' length Part # 8400P-003)
- Condensate Neutralizer (Part # 7450P-212)
- Condensate Removal Pump (Part # 554200)
- Communication Cable (Part # 7850P-093)
- 2" Vent Screens (Two Screens) (Part # 7850P-088)
- UL353 Low Water Cut-Off Kit (Part # 7855P-315)
- Conversion Kit

NOTE: When using an optional system sensor, pipe insulation must be wrapped around it to improve temperature measurement accuracy and increase overall system efficiency.

PART 2 – SAFETY REGULATIONS

A. OPERATION AND INSTALLATION WARNINGS

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

⚠ DANGER
Vapors from flammable liquids will explode and can 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 flue gas analyzer such that a CO level of no more than 400 ppm is exceeded at any time during operation.
Adjusting the "low fire offset" on the gas valve in even 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 flue gas analyzer.
Failure to follow these statements will result in property damage, severe personal injury, or death.
⚠ WARNING
This boiler must be installed by a licensed plumber, licensed gas fitter, and/or professional service technician. Improper installation and/or operation can cause a potentially hazardous situation, which, if not avoided, could result in serious injury or death, and will void the warranty.
HTP, Inc. 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 professional 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 and maintaining 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 boiler is subjected to fire, overheating, flood, physical damage, or any other damaging condition that might affect the operation of the unit. Have the boiler checked by a qualified 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 professional 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 professional service technician if the boiler needs repair or maintenance. If the original technician is unavailable, ask your gas supplier for a list of qualified service providers.
Keep the area around the boiler clean and free of all materials that can burn. DO NOT store or place gasoline, oils, spray paint, or other flammable products near the boiler.

⚠ WARNING

DO NOT use spray paint, hair spray, or any other flammable spray near the boiler or near the exterior fresh air intake port. DO NOT place any items in or around the exterior exhaust gas outlet port and/or fresh air inlet port that could restrict or block the flow in or out of the vent system.

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

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 boiler safety devices should be tested.

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

If the boiler is exposed to the following, do not operate until all corrective steps have been made by a qualified service technician:

1. FIRE
2. DAMAGE
3. WATER

This boiler is equipped with a three prong plug. It should only be plugged directly into a properly grounded three prong receptacle. DO NOT remove the ground plug from the plug.

DO NOT alter or modify the boiler or boiler controls. This can be dangerous and WILL VOID the warranty.

Failure to follow these statements could result in property damage, severe personal injury, or death.

NOTICE

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

This boiler provides a overheat shutdown limit. In the event the boiler water exceeds the set point of the control limit, the cutoff will trip and the boiler will shut down. Certain local codes require additional temperature limits. In addition, certain types of systems may operate at temperatures below the minimum set point of the limit provided with the boiler. Contact a qualified service technician for additional overheat controls.

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

⚠ WARNING

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.

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 boiler. Wiring errors can cause improper or dangerous operation. Failure to do so could result in an electrical shock, improper boiler operation, property damage, serious personal injury, or death.

CAUTION

Due to the low water content of the boiler, improper sizing of the boiler with regard to heating system load will result in excessive 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.

B. IMPROPER COMBUSTION

⚠ WARNING

Do not obstruct the flow of combustion and ventilating air. Adequate air must be provided for safe operation. Failure to keep the exhaust vent and intake pipe 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, do not turn off or disconnect electrical supply to the circulator. Instead, shut off the gas supply at a location external to the boiler.

D. WHEN SERVICING THE BOILER

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

E. BOILER SYSTEM

- Thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment. HTP recommends a suction strainer in all systems.
- 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.

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.

F. BOILER WATER CHEMISTRY

CAUTION

Chemical imbalance of the water supply may affect efficiency and cause severe damage to the appliance and associated equipment. 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.

The water must be potable, 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. Potable water is defined as drinkable water supplied from utility or well water in compliance with EPA secondary maximum contaminant levels (40 CFR Part 143.3) as shown in the table below. If the water contains contaminants higher than outlined by the EPA, water treatment is recommended and additional, more frequent maintenance may be required.

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

Contaminant	Maximum Allowable Level	Contaminant	Maximum Allowable Level
Total Hardness (Residential Use - Below 140^{o}F water temperature)	200 mg/l (12 grains/gallon)	Manganese	0.05 mg/l or PPM
Total Hardness (Commercial Use - 140^{o}F and above water temperature)	120 mg/l (7 grains/gallon)	pH	6.5-8.5
Aluminum	0.05 to 0.2 mg/l or PPM	Sulfate	205 mg/l or PPM
Chloride	100 mg/l or PPM	Total Dissolved Solids (TDS)	500 mg/l or PPM
Copper	1 mg/l or PPM	Zinc	5 mg/l or PPM
Iron	0.3 mg/l or PPM	Dissolved Carbon Dioxide (CO2)	15 mg/l or PPM

Table 2 – Water Quality Requirements

G. FREEZE PROTECTION FLUIDS

CAUTION
NEVER use automotive or standard glycol antifreeze, or ethylene glycol made for hydronic systems, with this boiler. Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems.
Consider boiler piping and installation when determining boiler location.

NOTE: Damages resulting from incorrect installation or from use of products not approved by HTP, Inc. ARE NOT covered by warranty.

H. HIGH ELEVATION INSTALLATIONS

⚠ WARNING
Natural gas at high elevation might contain less heating value than typical 1,000 BTU/cu ft and therefore can cause improper air / gas mix leading to improper combustion. For natural gas installations above 3,000 ft, call your gas provider to determine the heating value of the supplied natural gas.

PART 3 – TECHNICAL SPECIFICATIONS

MODEL		80W	100W	120W	140W	175W	199W
Installation		Indoor, Wall Hung, Fully Condensing					
Minimum / Maximum Input (Btu/Hr)		8,000 / 80,000	10,000 / 100,000	12,000 / 120,000	14,000 / 140,000	19,900 / 175,000	19,900 / 199,000
Flue System		Sealed Combustion Direct Vent, Power Vent					
Vent Run		2” (50 feet), 3” (100 feet), Schedule 40 PVC, CPVC, PP					
Weight (lbs)		90		100		110	
Gas Supply Pressure	**NG**	3.5” to 14” WC					
	LP	3.5” to 14” WC					
Power Supply	**Main Supply**	120V 60 Hz / 6a					
	Maximum Power Consumption	160W					
General Operating Conditions		**Temperature** • Ambient Temperature Range: 33 – 104°F (0.6 – 40°C) • Operating Relative Humidity: Up to 90% at 140°F (40°C) • Shipping and Storage Temperature Range: -4 – 176°F (-20 – 80°C) **Input Ratings** Power Supply and Communication (CN4): 14V DC					
Ignition System		Direct Electronic Ignition / Automatic Flame Sensing					
Burner System		Premixed Fuel Modulation Ceramic Fiber Infrared					
Gas Valve System		Combination Modulating (Current Proportional)					
Internal Pipe Material		Copper					
Dimensions		W 17.5” – H 34” – D 15.4”				W 19.7” – H 37” – D 16.8”	
Boiler Heat Exchanger Capacity		3 Gallons					
Main Controller / Control Panel		NGTB-900C / P-950EH					
Water Pressure		Min 12 – Max 30 PSI					
Connection Sizes	**Space Heating Supply / Return**	1 ¼” NPT					
	Gas Inlet	¾” NPT					
Materials	**Cabinet**	Painted Cold Rolled Carbon Steel					
	Heat Exchanger	Heat Exchanger: Stainless Steel					
Safety Devices		Optical Flame Sensor, Burner Plate High Limit (392°F), Water Temperature High Limit Sensor (200°F), Gas Leak Detection Sensor (Detects Natural Gas or Propane), Freeze Protection (Three Stage Operation - Activates at 46°F – See Freeze Protection in Installer Menu for Details), Exhaust Temperature High Limit Sensor (190°F), Blocked Flue Switch, Condensate Switch, Built-In Low Water Cut-Off Probe					

Table 3 – Technical Specifications

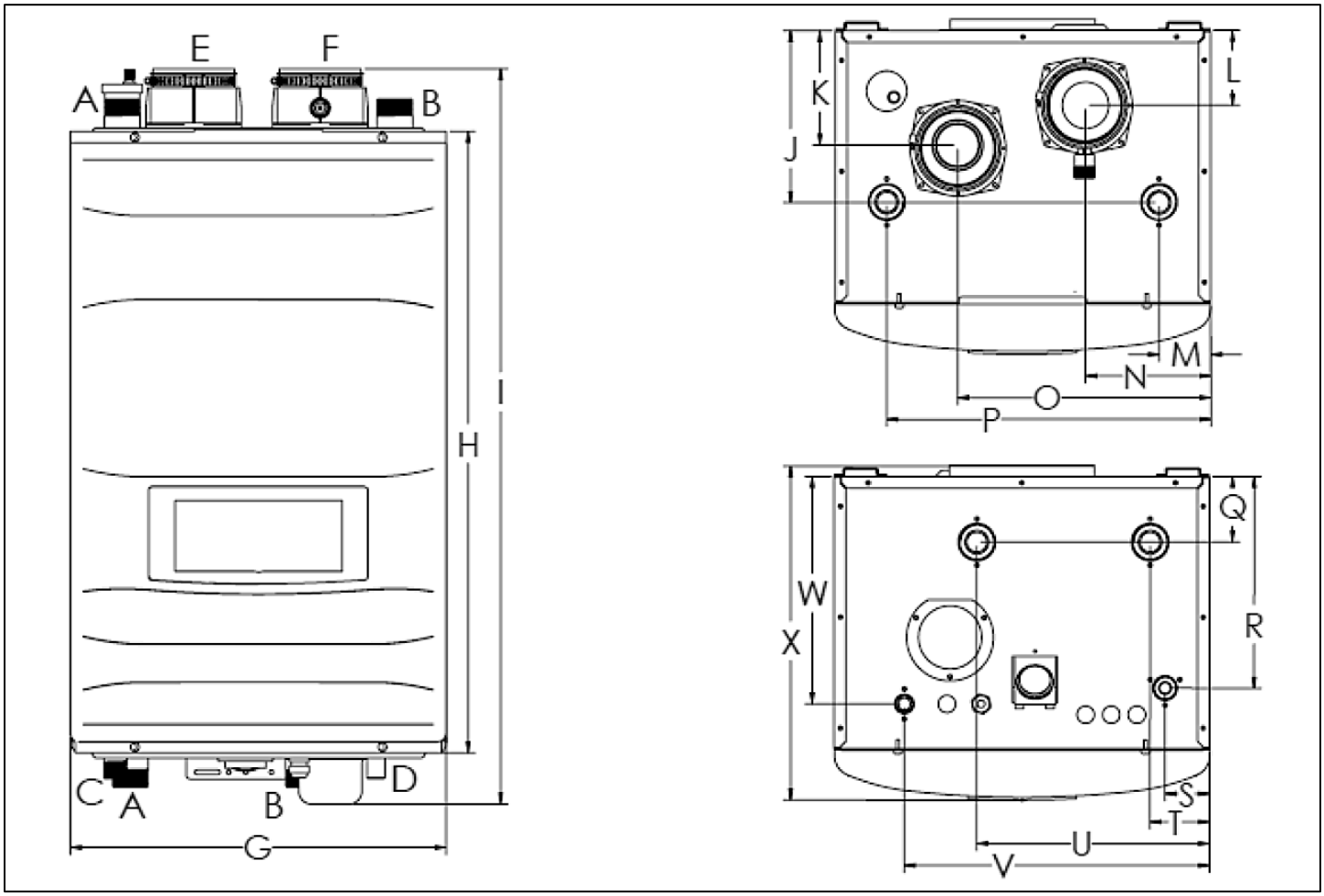


Figure 1 – Specifications and Dimensions

	DESCRIPTION	DIAMETER
A	CH Supply Adapter	1 ¼”
B	CH Return Adapter	1 ¼”
C	Gas Inlet Adapter	¾”
D	Condensate Adapter	½”
E	Intake Pipe Connection	3”
F	Exhaust Vent Connection	3”

MODEL	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
80W 100W 120W 140W	17.5	28.75	34	7.9	5.3	3.5	2.4	5.8	11.7	14.9	3.0	9.8	2.1	2.7	10.7	14.1	10.5	15.4
175W 199W	19.7	31.9	37	7.2	5.1	3.2	3.75	5.8	12.5	17.5	4.0	11.1	2.1	2.2	11.7	15.8	11.8	16.8

Table 4 – Specifications

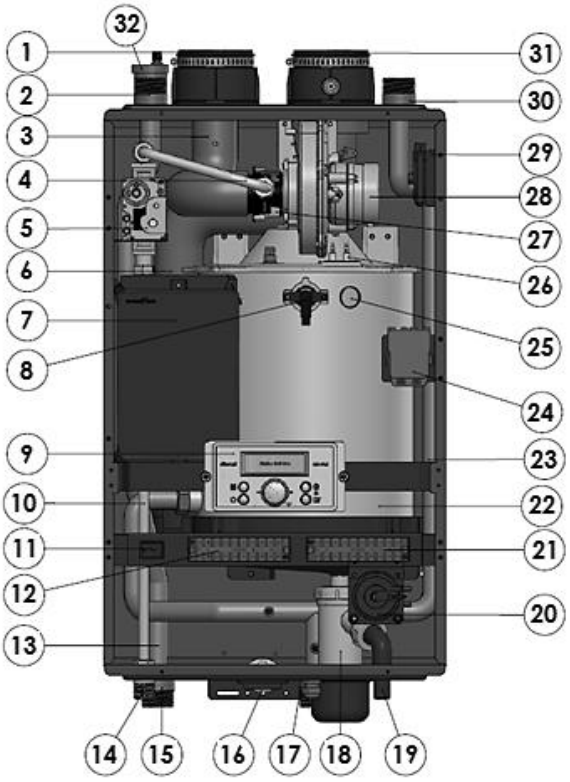


Figure 2 – Components (All Models)

NUMBER	COMPONENT DESCRIPTION	NUMBER	COMPONENT DESCRIPTION
1	Intake Pipe Adapter	**17**	CH Bottom Return Adapter
2	CH Top Supply Adapter	**18**	Condensate Trap
3	Air / Gas Mixing Pipe	**19**	Condensate Adapter
4	Gas Inlet Pipe 2	**20**	Condensate Air Pressure Switch
5	Gas Valve	**21**	Low Voltage Terminal Strip
6	Exhaust Duct	**22**	Heat Exchanger
7	Main PCB	**23**	CH Return Pipe
8	Flame Detection Sensor	**24**	Ignition Transformer
9	Control Panel	**25**	Flame viewing window
10	Gas Inlet Pipe 1	**26**	Ignitor rod
11	Manual ON/OFF Power Switch	**27**	Air/gas Mixer
12	High Voltage Terminal Block	**28**	BLDC Fan
13	CH Supply Pipe	**29**	Air Pressure Switch
14	Gas Inlet Adapter	**30**	CH Supply Adapter
15	CH Bottom Supply Adapter	**31**	Exhaust Vent Adapter
16	CH Pressure Gauge	**32**	Automatic Air Vent

Table 5 – Component List

How the Boiler Operates

Condensing technology intelligently delivers hydronic heating while maximizing efficiency. Outlined below are the features of the system and how they operate:

Stainless Steel Heat Exchanger - The highly efficient 316L stainless steel fire tube heat exchanger with internal aluminum is designed to extract all available heat from the combustion process and pass it into heat transfer fluid. The stainless steel construction provides protection for longer service life. The heat exchanger offers greater water content, providing lower system pressure and greater overall system efficiency.

10 to 1 Modulating Combustion System - The combustion system is specially designed to provide very high turn down. This combustion system will modulate the burner output to very low levels to match the system demand and achieve better overall control of the heating system for maximum efficiency and reliability.

Control – The integrated control system monitors the system and responds to internal and external signals to regulate fan speed and control boiler output. This allows the boiler to deliver only the amount of heat energy required and nothing more.

The control can be set up to monitor outdoor temperature through an outdoor sensor to regulate boiler set point temperature, increasing overall system efficiency while providing great comfort. The system can be further enhanced by installing an indirect water heater to provide domestic hot water.

The control can regulate the output of multiple boilers through its cascade system function by establishing one boiler as the master and the other connected boilers as followers. The master boiler requires a sensor to provide feedback on set point temperature in order to adjust heating output from the connected boilers. Through the use of multiple UFT boilers cascaded systems offer greater system turndown and redundancy.

Electronic LCD Display – The high resolution display allows the user to monitor boiler functions. The display also provides the means to program the system parameters to maximize the efficiency of the system design.

Combustion System (Blower – Gas Valve – Mixer – Burner – Spark Ignition) – The highly efficient spark ignition combustion system uses a variable speed blower to adjust combustion as the system requires more or less energy. The negative regulated gas valve provides only the amount of fuel required to ensure clean combustion. The mixer accurately regulates the combination of gas and air throughout the modulating range to ensure high reliability. The burner is constructed of durable ceramic metal fiber for long service life.

Boiler Sensors (Return – Supply – Flue - Outdoor) - Sensors provide highly accurate temperature monitoring to assure accurate system control. These sensor inputs can be monitored through the boiler control system and display.

Pressure Gauge – Allows the user to monitor system pressure.

System Safeties – The boiler is provided with many safety features to ensure reliable and safe operation. Each safety is connected to the boiler control. The boiler will alert the user if an unsafe condition occurs and needs to be addressed. The following are provided safeties: Flue Pressure Switch (monitors flue pressure), Burner High Limit (monitors burner plate temperature), High Limit Water Switch (monitors boiler water temperature), Low Water Sensor (monitors water level in the heat exchanger), optic flame sensor (monitors flame quality), Flue Sensor (monitors flue temperature), Condensate Pressure Switch (monitors pressure to ensure condensation does not back up into boiler).

Manual Air Vent – Each boiler is equipped with an air vent to discharge air from the system during start–up.

Intake and Exhaust Adapters – The boiler is equipped with adapters to ease connection to the vent system. The adapters are provided with clamps and seals to secure field supplied piping, and test ports to ease monitoring of the combustion system. Each boiler is supplied with a 6 inch piece of CPVC that must be connected into the exhaust vent adapter.

Boiler 1 ¼" Inlet and 1 ¼" Outlet Connection – Boilers are equipped with both top and bottom piping connections for greater installation flexibility.

Gas Connection – The boiler is equipped with a ¾" gas connection to connect the incoming gas supply.

Field Wiring and Power Switch – Each boiler is supplied with a power switch to cut off power. The boiler is also equipped with two front mounted terminal strips. These terminal strips are separated into low and line voltage to ease system wiring.

Condensate Trap and Hose Assembly – Each boiler has a built-in condensate trap to control the discharge of condensate produced by the boiler during normal operation. A corrugated condensate hose is also provided to ensure proper drainage of condensate into the pump or drain.

Low Water Cut Off Probe – LWCO is provide with each boiler to assure the boiler has adequate water level to eliminate overheating and even damaging the boiler heat exchanger .

Pump Service Mode – Allows manual operation of pumps to commission system and check pump operation.

DHW Priority – The boiler control allows connection of a DHW temperature sensor / aquastat to the low voltage terminal strip. When the aquastat calls for heat, the module activates the DHW pump, shuts down the boiler and CH pumps, and immediately sets the target outlet water temperature to 180^{o}F (factory default). This provides automatic priority heat allocation to the indirect water heater for maximum response and recovery. The DHW pump continues for 1 minute (factory default) after the heating cycle to deliver the most possible heat.

DHW / Central Heating (CH) Rotation – If a DHW call for heat is received while a central heating call is in progress, the control will start the DHW pump and shut the boiler and CH pumps off. If the central heating call is still active while the DHW call is in operation, the control will wait for 30 minutes (time adjustable by the installer) then switch back to the central heating demand. The control will switch back and forth until one of the heat demands ends.

Cascade Operation - When multiple boilers are installed, they can be wired together in a cascaded system. A maximum of twenty (20) boilers can be controlled from a single boiler control. In Cascaded Systems, one boiler is designated as the “Master” and the other boilers are designed as “Followers”.

When the Master boiler receives a call for heat from a room thermostat, the control will determine the set point. If Outdoor Reset or 0-10V is used, connect the outdoor sensor or 0-10V to the low voltage terminals provided on the Master boiler. The set point will be determined based on the programmed reset curve parameters. If Outdoor Reset or 0-10V is not used, a fixed temperature set point can be programmed into the control. **NOTE:** This setpoint is for the system sensor.

If the water temperature at the system sensor is less than the set point– the cascade system temperature differential (32:Cd), then the control will initiate a call for heat. The Master boiler will energize the lead boiler in the cascade system. In a new system start-up this will be the Master boiler.

The boiler will fire at its ignition speed and then modulate its firing rate to maintain the set point. If the first boiler reaches 80% of its firing rate, the Master will modulate down and split the load in half. At this point, the Master will fire the second boiler in the system. If there are more than two boilers in the system, the same principle will be applied. Once the Master reaches 80% of the capacity, it will modulate down and split the total amount of load by the number of unit in operation.

If the set point still cannot be met, the Master will continue firing more Followers until either the heat demand is met or all boilers on the Cascade are firing. As the heat demand decreases, all boilers on will modulate down according to the heating load. The first boiler to modulate down to 40% will shut off. The same principle will be applied to the remaining boilers in operation until the heating demand or system sensor is satisfied. When the system sensor is satisfied, the boilers will turn off. However, the system pump will continue to operate until the heating demand is satisfied.

CAUTION

When installing a cascaded system, it is important that the boilers are the same model. Failure to ensure the boilers are the same model will result in improper system operation, wasted time, money, and possible property damage and personal injury. Such damages ARE NOT covered by product warranty.

PART 4 – PREPARE BOILER LOCATION

A. UNCRATING THE BOILER

⚠ WARNING

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

CAUTION

Cold weather handling – If boiler has been stored in a very cold location (below 0°F) before installation, handle with care until the plastic components come to room temperature.

Remove all sides of the shipping crate to allow the boiler to be lifted into its installation location.

CAUTION

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.

B. BEFORE LOCATING THE BOILER

⚠ WARNING

Incorrect ambient conditions can lead to damage to the heating system and put safe operation at risk. Ensure that the boiler installation location adheres to the information included in this manual. Failure to do so could result in property damage, serious personal injury, or death.

CAUTION

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

1. Installation Area (Mechanical Room) Operating Conditions
   - Ensure ambient temperatures are higher than 32°F/0°C and lower than 104°F/40°C.

- 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

CAUTION

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 the heat exchanger and other 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.

⚠ WARNING

This boiler is certified for indoor installations only. Do not install the boiler outdoors. Failure to install this boiler indoors could result in substantial property damage, severe personal injury, or death.

This boiler must be installed as described in this manual: upright, with the vent adapters in the vertical position. 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.

2. Check for nearby connections to:
   - System water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
   - Condensate drain

CAUTION

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. The boiler should be located near a floor drain, or installed in an adequately drained drain pan. HTP WILL NOT be held liable for leakage damages.

To conserve water and energy, insulate all water piping, especially the hot and recirculation water lines.

3. Check area around boiler. Remove any combustible materials, gasoline, and other flammable liquids.

⚠ WARNING

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

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 an boiler.
NOTE: When installing in a zero 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.

C. LEVELING

⚠ CAUTION

In order for the condensate to properly flow out of the collection system, the boiler must be installed level. Failure to ensure the boiler is installed level will result in improper boiler operation.

D. CLEARANCES FOR SERVICE ACCESS

See Figure 3 and Table 6 for recommended service clearances. If these minimum clearances are not provided, it may not be possible to service the boiler without removing it from the space.

⚠ WARNING

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

MINIMUM CLEARANCES	
Installation Clearances from Non-Combustibles / Combustibles	Recommended Service and Proper Operation Clearances
Top	18 in. (45.7 cm)
Back	0 in. (0 cm)
Bottom	12 in. (30.45 cm)
Front	24 in. (60.9 cm)
Right Side	3 in. (7.6 cm)
Left Side	

Table 6 – Minimum Installation and Service Clearances

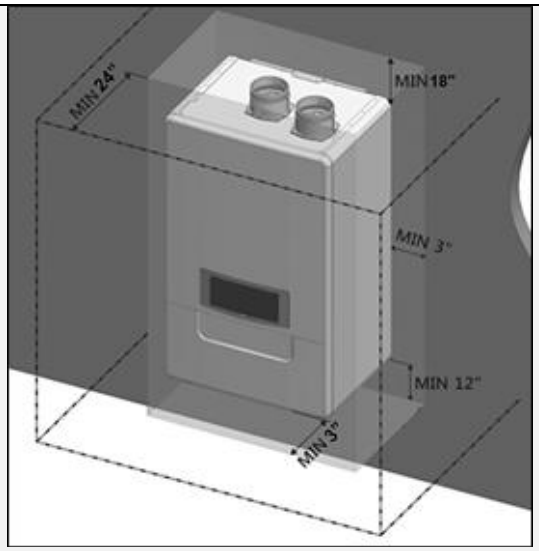


Figure 3 – Recommended Service Clearances

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

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

MINIMUM CLEARANCES FROM COMBUSTIBLE MATERIALS

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

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.

E. RESIDENTIAL GARAGE AND CLOSET INSTALLATIONS

CAUTION

Check with your local Authority Having Jurisdiction for requirements when installing boiler in a garage or closet. 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.

PRECAUTIONS

If the boiler is located in a residential garage, it should be installed per the latest edition of the National Fuel Gas Code, ANSI Z223.1, and CGA-B149 Installation Code in Canada.

- Mount the bottom of the boiler a minimum of 18" above the floor of the garage, to ensure the burner and ignition devices are well off the floor.
- Locate or protect the boiler so it cannot be damaged by a moving vehicle.

⚠ WARNING

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. Failure to comply with these warnings could result in substantial property damage, severe personal injury, or death.

F. EXHAUST VENT AND INTAKE PIPE

⚠ WARNING

Vents must be properly supported. The 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. Venting must be readily accessible for visual inspection for the first 3' from the boiler.

NOTE: To prevent combustion air contamination, see Table 7 in this section when considering exhaust vent and intake pipe termination.

Exhaust vent and intake pipe may be vented vertically through the roof or out a side wall. Venting methods are detailed in the Venting Section. Do not attempt installation using any other means. Be sure to locate the boiler so exhaust vent and intake piping can be routed through the building and properly terminated. Exhaust vent and intake piping lengths, routing, and termination method must comply with methods and limits given in the venting section.

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

Failure to comply with these requirements could result in product damage, 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 piping for the boiler as described in the Venting section. 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 below. For example, do not pipe intake near a swimming pool. Avoid areas subject to exhaust fumes from laundry facilities. These areas always contain contaminants. Contaminated air will damage the boiler, resulting in possible substantial property damage, severe personal injury, or death.

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 7

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 boiler. This will cause flue gas spillage or boiler malfunction, resulting in possible substantial property damage, severe personal injury, or death.

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, the following steps must be followed.

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 all doors between the common venting system and other spaces in the building. Turn on clothes dryers and any boilers 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 boiler being inspected. Follow the lighting instructions. Adjust the thermostat so the boiler 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 boiler remaining connected to common venting system properly vents when tested as outlined, return doors, windows, exhaust fans, fireplace dampers and any other gas burning boiler to their previous condition of use.

7. Any improper operation of the common venting system should be corrected so the installation conforms to the National Fuel Gas Code, ANSI Z223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Appendix G in the National Fuel Gas Code, ANSI Z 223.1.

Figure 4 - CO Warning Label

J. WALL-MOUNTING THE BOILER

⚠ WARNING

The boiler must be installed on a wall that can bear its weight (more than 110 lbs. when fully plumbed and full of water). Installing the boiler on a wall which cannot support its weight could result in property damage, personal injury, or death.

The boiler may be installed on any suitable internal wall (suitable sound-proofing may be required when installing onto a stud partition wall).

⚠ WARNING

This boiler is too heavy for one person to lift. It is highly recommended to install the boiler with two people. Use caution as to not drop the boiler, which could damage the boiler and cause property damage and/or severe personal injury. Verify that the boiler is properly and securely mounted before leaving unsupervised. Failure to comply with the above and properly mount the boiler could result in substantial property damage, severe personal injury, or death.

This wall mounting system is not seismic rated and should not be applied as such. Failure to comply with the above and properly mount the boiler could result in substantial property damage, severe personal injury, or death.

POSITIONING THE BOILER ON THE WALL

1. Attach the wall bracket on the location where you want to install the boiler. Ensure it is level and on stud (16” centers) before proceeding.

2. Mark the four drill holes with a pencil or marker. Remove the wall bracket.
3. Drill four (4) holes using a 5/32 drill bit at the marked hole locations.
4. Mount the wall bracket to the wall with the four (4) included anchor bolts. Ensure the mounted bracket is level. See Figure 5A.
5. Align the boiler bracket grooves on the back of the boiler with the tongues on the wall bracket and hang the boiler on the bracket. See Figure 5B.

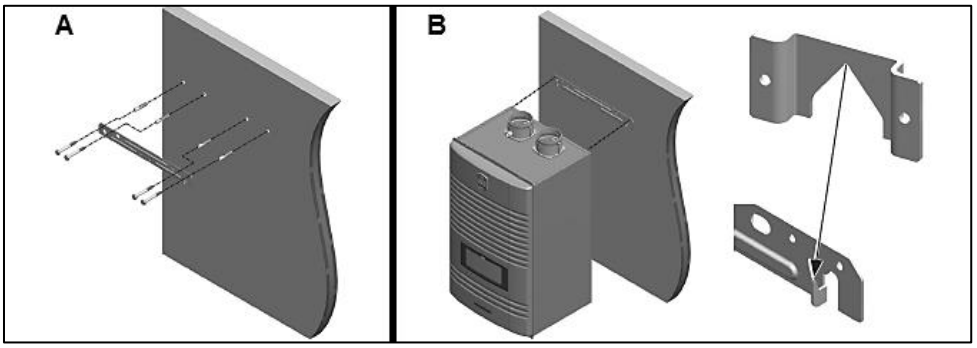


Figure 5 – Wall Mounting the Boiler

PART 5 – VENTING

⚠ DANGER
Vent this boiler in accordance with these instructions. Failure to do so will result in property damage, severe personal injury, or death.
⚠ WARNING
DO NOT mix vent systems or materials unless specifically told to do so in this manual.
DO NOT thermally insulate the exhaust vent or intake pipes.
DO NOT use an electric damper, vent damper, or draft hood with this boiler.
DO NOT locate the exhaust vent or intake pipe terminations where exposed to prevailing winds.
Moisture will be produced by the exhaust vent. Take precautions when determining exhaust vent termination. Moisture may fall from the vent termination to the ground and turn to ice in freezing conditions. Moisture or ice can produce a hazardous condition.
Exhaust condensate is acidic, and could deteriorate the surface below the exhaust vent termination. Ensure this surface is in good repair (sealed, painted, etc.) to prevent deterioration.
Pitch the exhaust vent pipe ¼" back to the boiler. This ensures that condensate in the exhaust vent returns to the boiler and drains properly.
Failure to follow these instructions could result in property damage, severe personal injury, or death.

A. INTAKE PIPE AND EXHAUST VENT GUIDELINES

1. Vent system must be installed in accordance with local codes, or, in absence of local codes, the National Fuel Gas Code, ANSI Z223.1 / NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.

2. **For installation in Canada**, installer supplied plastic vent piping must comply with CAN/CGA B149.1 and be certified to the Standard for Type BH Gas Venting Systems, ULC-S636. Components of this listed system must not be interchanged with other vent systems or unlisted pipes or fittings. All plastic components and specified primers and glues must be from a single system manufacturer and must not be intermixed with another system manufacturer's products. Clean and dry all applicable surfaces before applying cement.

3. This appliance is designed to be installed in a power vent (using indoor air for combustion and vented to the outdoors) type, or as a direct vent (sealed combustion) type. In power vent installations, indoor air is used for combustion and exhaust gases are vented directly to the outdoors through a sealed exhaust vent piped through the wall or roof. In direct vent installations, combustion air must be supplied directly from the outdoors to the burner, and the flue (exhaust) gases should be vented directly to the outdoors through the wall or roof.

4. This boiler uses 2" or 3" diameter pipe for exhaust vent and intake pipe. It is important to ensure an airtight seal from the boiler collar to the vent terminations. See Table 9 for a list of Approved Vent Materials.

5. Do not install venting system components on the exterior of the building except as specifically required by these instructions.
   - Vent terminals must be at least 1 foot from any door, window, or gravity inlet into the building.
   - Maintain the correct clearance and orientation between the exhaust vent and intake pipe terminals.
   - The exhaust vent and air intake terminals must be at the same height and their center lines must be spaced apart 1 foot minimum.

- The bottom of the exhaust vent and intake pipe terminals must be at least 1 foot above the normal snow accumulation level. In no case should these terminals be installed less than 1 foot above normal snow accumulation level.
- Do not install the exhaust vent terminals directly above windows or doors.
- Intake pipe terminal must not terminate in areas that might contain combustion air contaminates, such as near swimming pools.
- For sidewall venting, the minimum horizontal distance between adjacent exhaust vent terminations is 1 foot. It is recommended this distance be greater than 1 foot to better avoid frost damage to building surfaces.
- For roof venting, minimum horizontal distance between any adjacent exhaust vent termination is 1 foot.
- 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.
- Do not locate vent over public walkways, driveways, or parking lots. Condensate could drip and freeze, resulting in a slip hazard or damage to vehicles and machinery.
- 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.
- DO NOT vent the appliance in a chimney flue serving a separate appliance designed to burn solid fuel. The appliance may only be vented in vacant chimneys.
- 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 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.

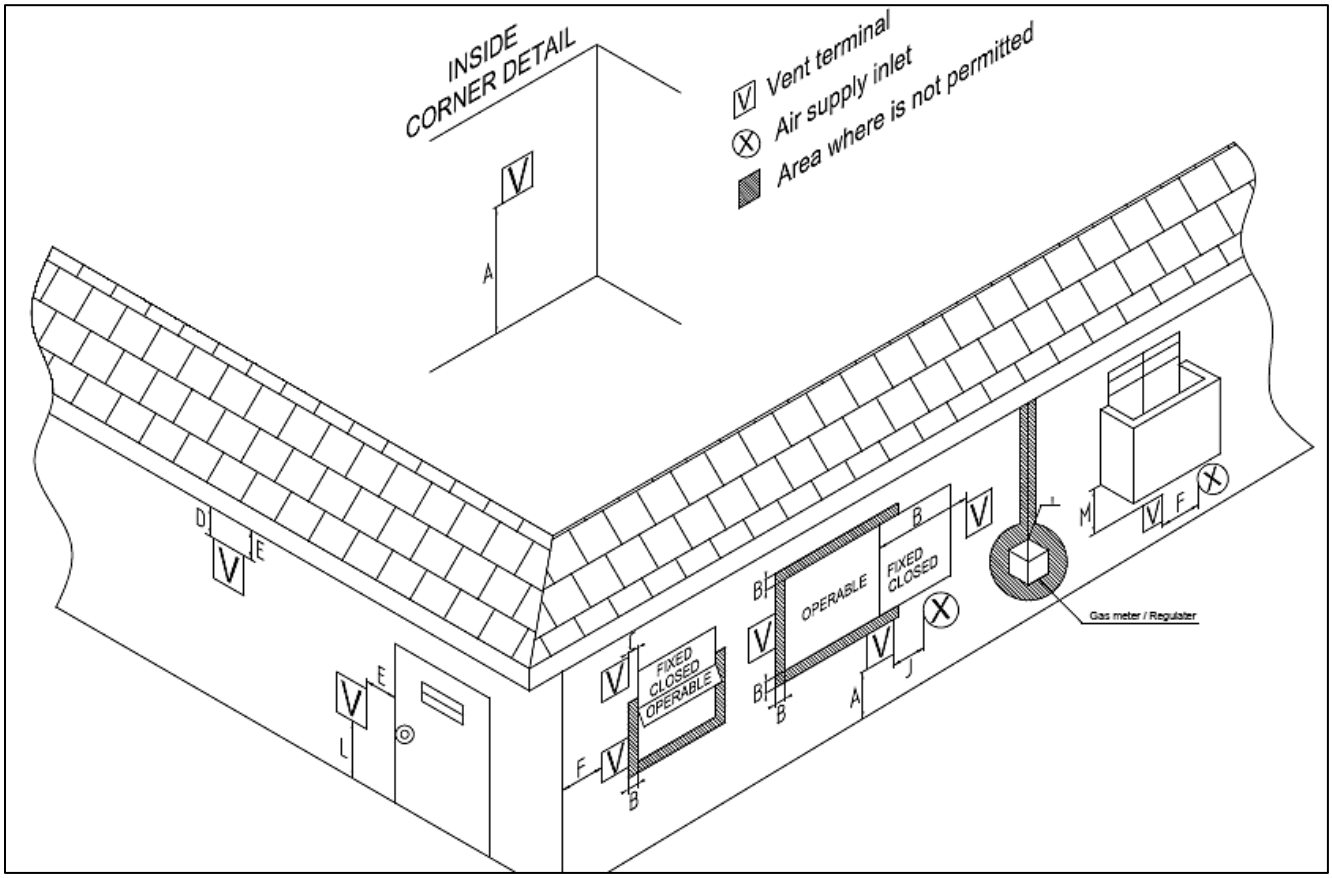


Figure 6 – Vent Termination Detail

	DESCRIPTION	US	CANADA
A	Clearance above grade, veranda, porch, deck, or balcony	1 foot	1 foot
B	Clearance to window or door that may be opened	1 foot	3 feet
C	Clearance to permanently closed window	*	*
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet 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	*	3 feet with a height 15 feet above meter / regulator assembly
I	Clearance to service regulator vent outlet	*	3 feet
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other boiler	1 foot	3 feet
K	Clearance to a mechanical air supply inlet	3 feet above if within 10 feet horizontally	6 feet
L	Clearance above paved sidewalk or driveway	*	7 feet
M	Clearance under veranda, porch, deck, or balcony	*	1 foot

Table 8 – Vent Termination Clearances

***NOTE:** For clearances not specified in ANSI Z223.1/NFPA 54 or CAN/CSA-B 149.1, please use clearances in accordance with local installation codes and the requirements of the gas supplier.

B. APPROVED VENT MATERIALS

NOTICE

Consult Table 9 or the most recent edition of ANSI Z223.1/NFPA 54 or CAN/CGA B149.1 as well as all applicable local codes and regulations when selecting vent pipe materials.

APPROVED EXHAUST VENT AND INTAKE PIPE MATERIAL			
Item	**Material**	**Standards for Installation in:**	
		United States	**Canada**
Exhaust vent or Intake pipe and fittings	CPVC schedule 40	ASTM-D2846	PP, CPVC, and PVC venting must be ULC-S636 Certified. IPEX is an approved manufacturer in Canada, supplying vent material listed to ULC-S636.
	PVC schedule 40	ANSI/ASTM D1785	
	Polypropylene	ULC-S636, UL-1738	
	Stainless Steel AL29-4C	Certified for Category IV and direct vent appliance venting	Certified for Category IV and direct vent appliance venting
Pipe Cement	PVC	ANSI/ASTM D2564	IPEX System 636 Cements & 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 warranty.
- PVC/CPVC pipe and fittings of the same diameter are considered interchangeable.
- Use of cellular core pipe PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenysulfone) in nonmetallic venting systems is prohibited.
- DO NOT connect PVC/CPVC to Polypropylene without an approved vent connector.
- Any transition to Polypropylene MUST be done in the vertical within five (5) feet of the appliance.
- When installing AL29-4C vent piping, install a PVC-to-stainless adapter at the appliance vent connection, and at the termination when using an HTP PVC termination kit. DO NOT mix AL29-4C piping from different manufacturers unless using adapters specifically designed for the purpose by the manufacturer.
- Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.
- DO NOT obstruct the flow of combustion or ventilation air.
- When using Pipe Cement/Primer, follow the instructions included with the Cement/Primer closely. Clean and dry all applicable surfaces before applying.

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

Table 9 – Approved Venting Materials

⚠ WARNING

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 must be pitched a minimum of ¼" 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.

CAUTION

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.

C. ALLOWED COMBINED VENT LENGTHS

2" COMBINED VENT LENGTH		3" COMBINED VENT LENGTH		MAXIMUM # OF 90° ELBOWS (2" and 3" VENT DIAMETERS)
MINIMUM	**MAXIMUM**	**MINIMUM**	**MAXIMUM**	6
14' (4.2M)	50' (15M)	14' (4.2M)	100' (30M)	

Table 10 – Approved Vent Lengths

The total equivalent length of exhaust vent and intake pipe should not exceed fifty (50) feet (15M) in 2" pipe, or one hundred (100) feet (30M) in 3" pipe.

a. The equivalent lengths of friction loss in elbows are listed below:
- 5 feet (1.5M) for each additional 3" 90° elbow
- 2.5 feet (.75M) for each additional 3" 45° elbow
- 8 feet (2.4M) for each additional 2" 90° elbow
- 4 feet (1.2M) for each additional 2" 45° elbow
- Some terminations are considered elbows, and deduction should be applied. For example, a turndown 90° or an open T termination should be considered a 90° elbow.

- For 2” diameter installations, install a reducing coupling in a vertical section of pipe ABOVE the pipe clamp installed on the water heater. See Figure 8.

b. For example: If the 2” exhaust vent has two 90^{o} elbows and 10 feet of PVC pipe we will calculate: Exhaust Vent Equivalent Length = (2x8) + 10 = 26 feet.

Further, if the 2” intake pipe has one 90^{o} elbow, one 45^{o} elbow, and 10 feet of PVC pipe, the following calculation applies: Intake Pipe Equivalent Length = 8 + 4 + 10 = 22 feet.

The Exhaust Vent Equivalent Length + the Intake Pipe Equivalent Length equal the Total Equivalent Length. In this example, the Total Equivalent Length is 48 feet.

c. The minimum Total Equivalent Length is fourteen (14) feet (4.2M).

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

⚠ WARNING

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 must be pitched a minimum of ¼” 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.

CAUTION

Failure to provide a minimum total vent length of 14 equivalent feet could result in property damage and improper appliance operation.

D. TIGHTENING BOILER COLLAR TO EXHAUST VENT AND INTAKE PIPE

NOTE: The included 6” length of 3” CPVC pipe MUST BE INSTALLED in the exhaust vent connection BEFORE venting the boiler.

⚠ WARNING

Failure to properly install the included 6” length of 3” CPVC pipe BEFORE venting the boiler could result in product damage, severe personal injury, or death.

This boiler uses 3” diameter adapters for exhaust vent and intake pipe. In order to use 2” pipe, it is required to reduce pipe size in a vertical length of pipe with a reducing coupling (not included). Follow the steps below to install 3” pipe into the boiler adapter. See Figure 7 for details.

1. Clean and dry the boiler connection. DO NOT use primer or cement on the boiler connection.
2. Push the included 6” length of CPVC pipe into the connection until it touches the bottom of the fitting.
3. Tighten the clamps using a screwdriver.
4. Ensure the pipe is secure before continuing installation.
5. For 2” installations, install a reducing coupling in a vertical section of pipe. See Figure 8.

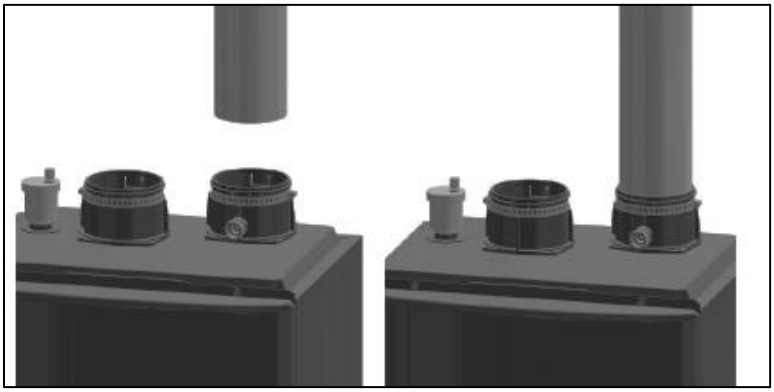


Figure 7 – Installing the 6” Length of CPVC into the Exhaust Vent Connection

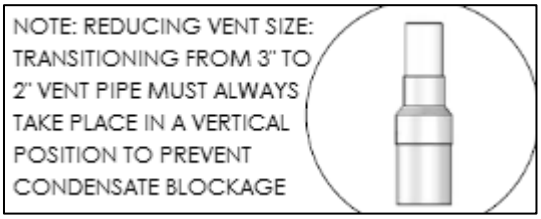


Figure 8 – Transitioning from 3" to 2" Vent Pipe

E. VENT TERMINATION

1. Direct Vent, Two Pipe Roof and Sidewall Vent Terminations

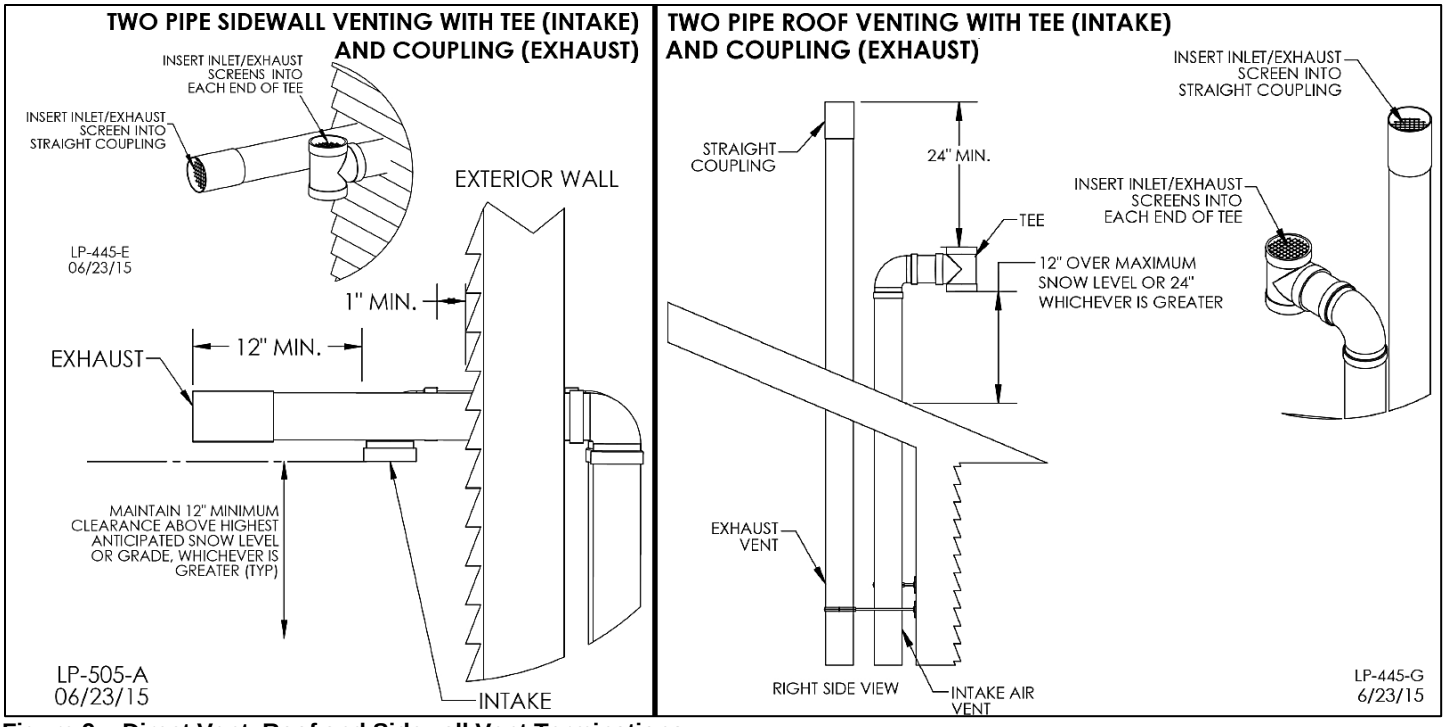


Figure 9 – Direct Vent, Roof and Sidewall Vent Terminations

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of ¼" 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 at 4 foot intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.

2. Direct Vent, Optional Horizontal and Vertical Vent Kits

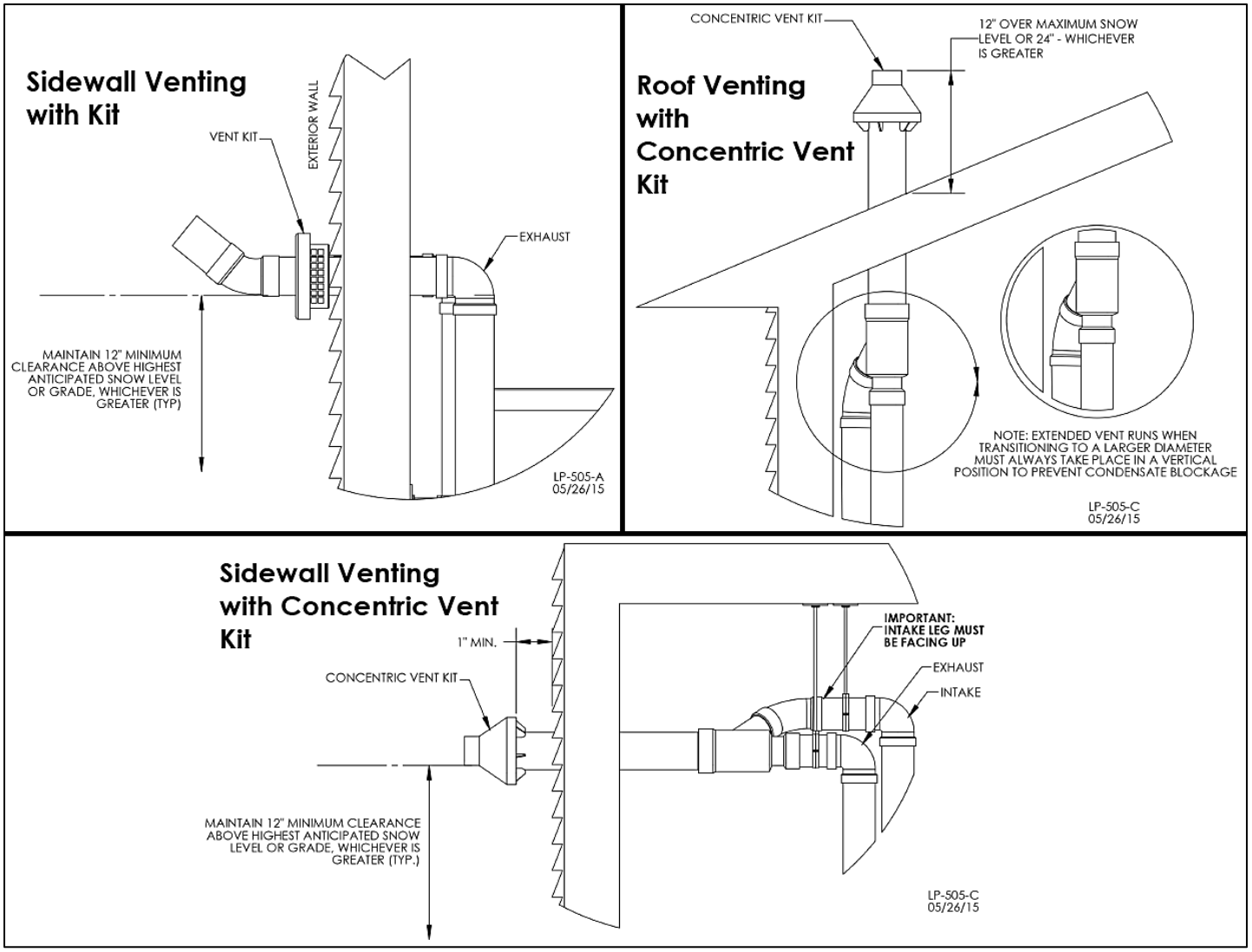


Figure 10 – Direct Vent, Vent Terminations (With Optional Kits)

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of ¼" 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 at 4 foot intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.

3. Snorkel Venting

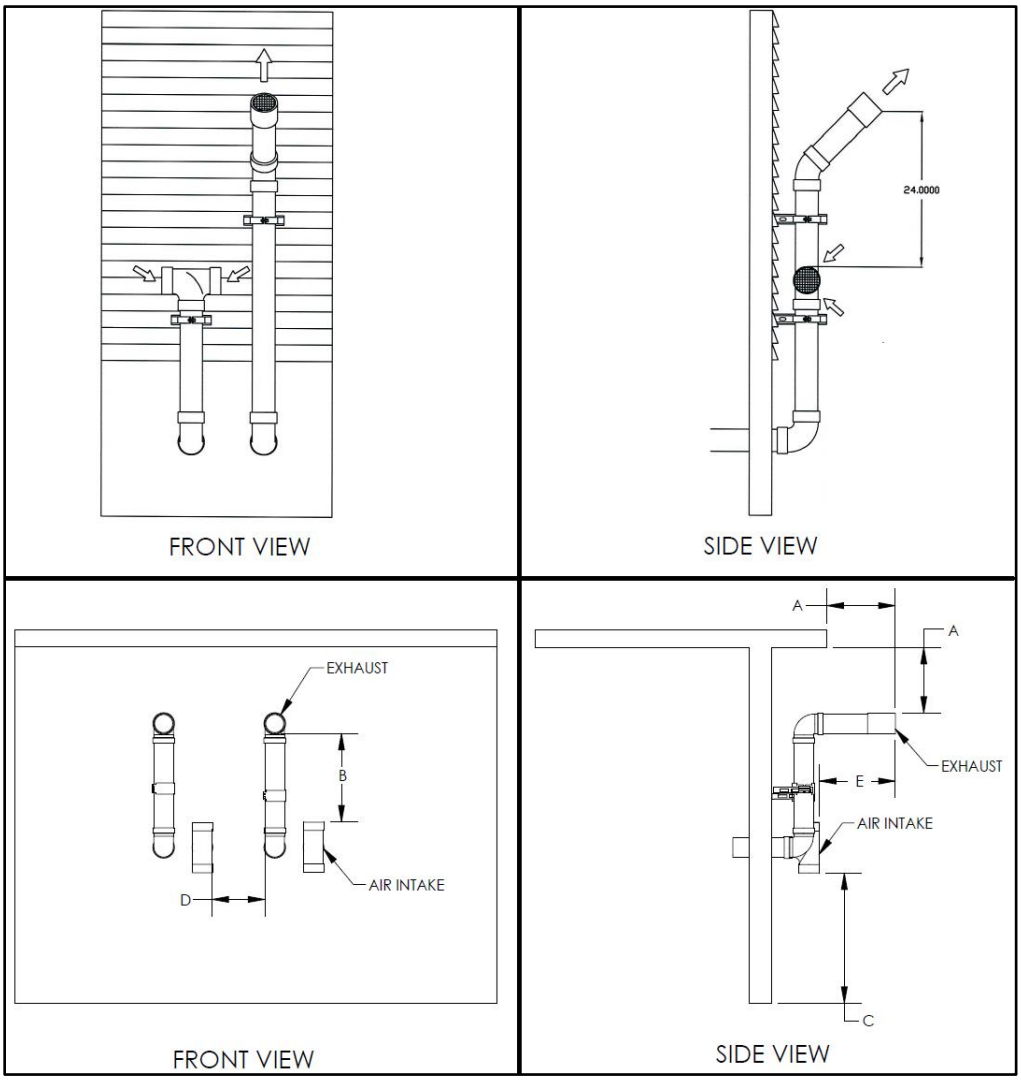


Figure 11 – Horizontal Venting - NOTE: Drawing is meant to demonstrate system venting ONLY.

NOTES:
A. For every 1” of overhang, the exhaust vent must be located 1” vertical below overhang (overhang means top of building structure and not two adjacent walls [corner of building]).
B. Typical installations require 12” minimum separation between bottom of exhaust outlet and top of air intake.
C. Maintain 12” minimum clearance above highest anticipated snow level or grade (whichever is greater).
D. Minimum 12” between vents when installing multiple vents.
E. 12” minimum beyond air intake.

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of ¼” 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 at 4 foot intervals on the vent pipe. Boiler venting must be readily accessible for visual inspection for the first three feet from the boiler.

4. Power Vent, Indoor Combustion Air Installation 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 7.**

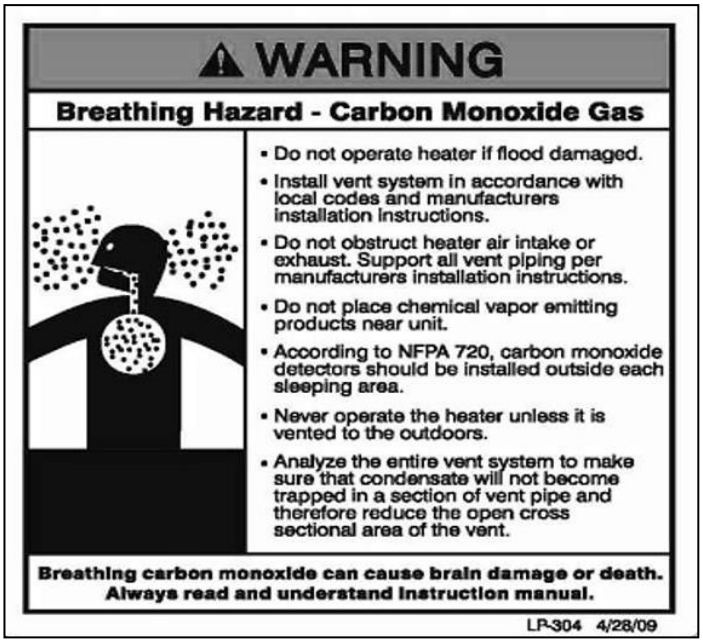
Combustion air from the indoor space can be used if the space has adequate area or when air is provided through a duct or louver to supply sufficient combustion air based on the boiler input. **Never obstruct the supply of combustion air to the boiler.** If the boiler is installed in areas where indoor air is contaminated (see Figure 12) it is imperative that the boiler be installed as direct vent so that all combustion air is taken directly from the outdoors into the water boiler intake connection.

Unconfined space is space with volume greater than 50 cubic feet per 1,000 Btu/hour (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.

Confined space is space with volume less than 50 cubic feet per 1,000 Btu/hour (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. See Figure 13.



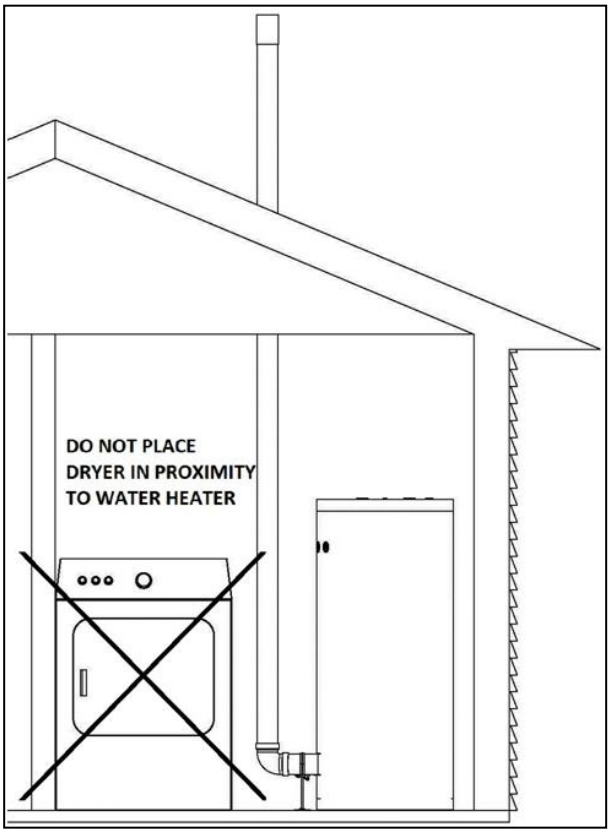


Figure 12 – LP-325-X

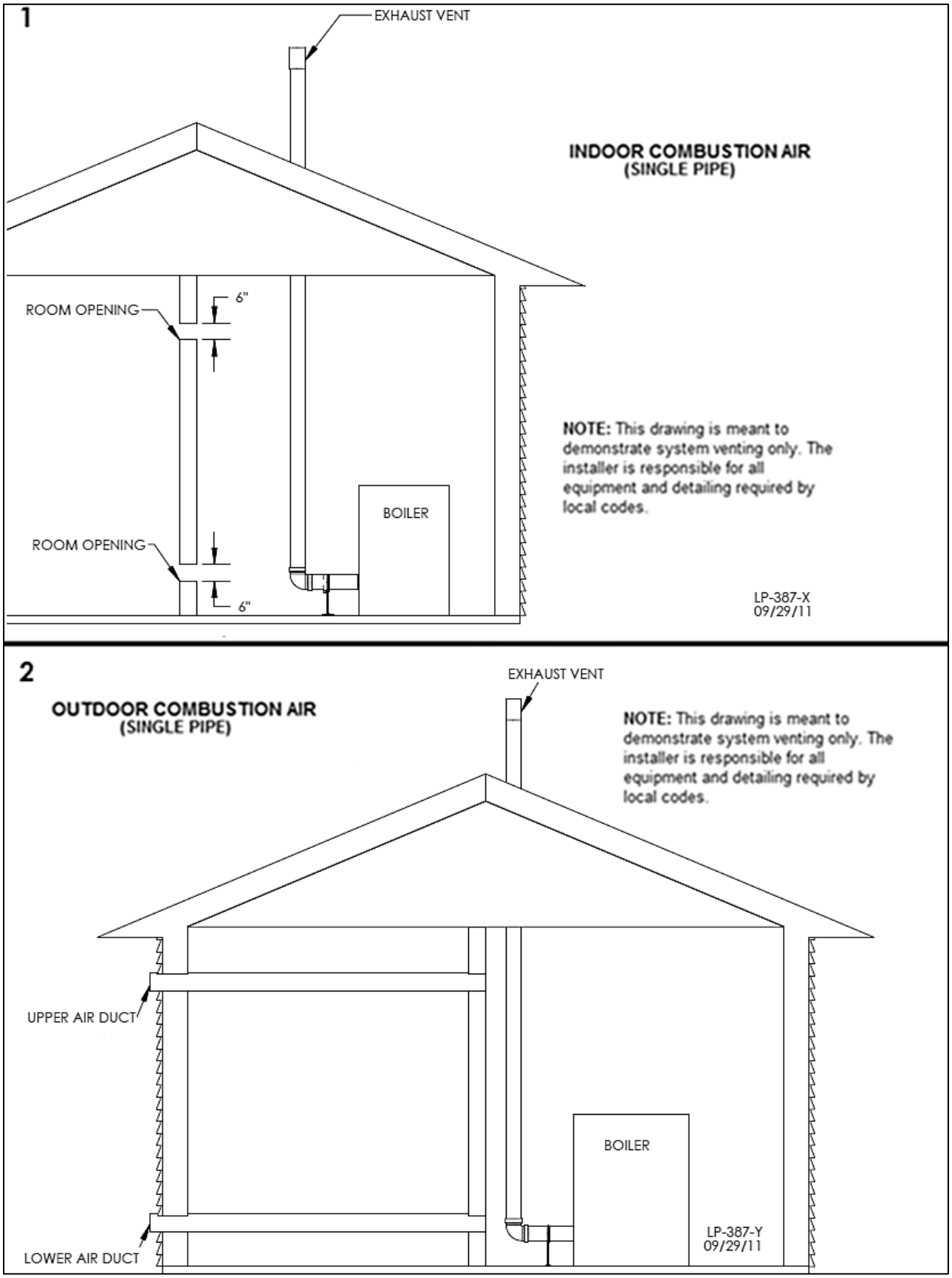


Figure 13 – 1, 13 - 2 NOTE: These drawings are meant to demonstrate system venting only. The installer is responsible for all equipment and detailing required by local codes.

5. Screen Installation

After connecting the intake air and exhaust vent pipes, it is required to install the included screens into the exhaust vent and intake pipe terminations to prevent damages to the unit due to blockages. Clean the vent terminations and cement the screens into the terminations. See Figure 14 for installation detail.

SAFETY INSTRUCTIONS
Do not connect any other boiler vents to the boiler exhaust vent or intake pipes.

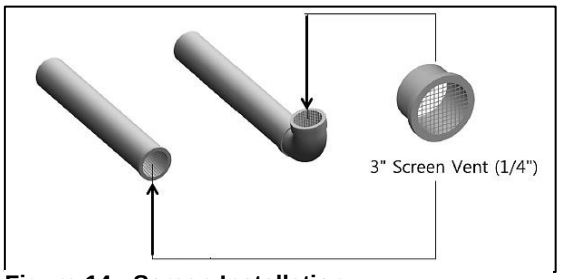


Figure 14 - Screen Installation

PART 6 – INSTALL THE CONDENSATE DRAIN

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 3 and 4. This condensate must be drained away from the boiler and disposed in accordance with all local regulations.

2. Use corrosion-resistant materials approved by the Authority Having Jurisdiction (AHJ) to drain condensate. In the absence of an AHJ, the included flexible plastic hose, or field supplied ½" PVC and CPVC drain pipe complying with ASTM D1785, F441, or D2665 may be used. Cement must comply with ASTM D2564 for PVC or F493 for CPVC. For Canadian applications, use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

3. Local building codes may require an in-line neutralizer to be installed (not included) to treat the condensate. 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.

4. Route the drain line to a nearby floor drain, laundry tub, or condensate pump.

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.

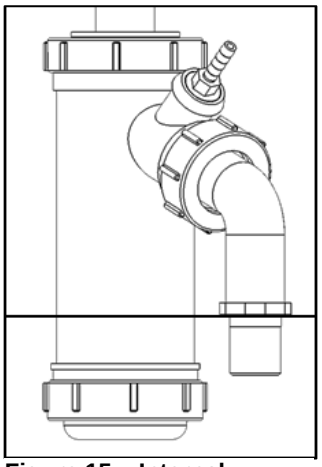


Figure 15 – Internal Condensate Trap

5. 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.

NOTE: This boiler has an internal condensate trap that must be cleaned and maintained. See Maintenance section of this manual for instructions on maintaining the trap.

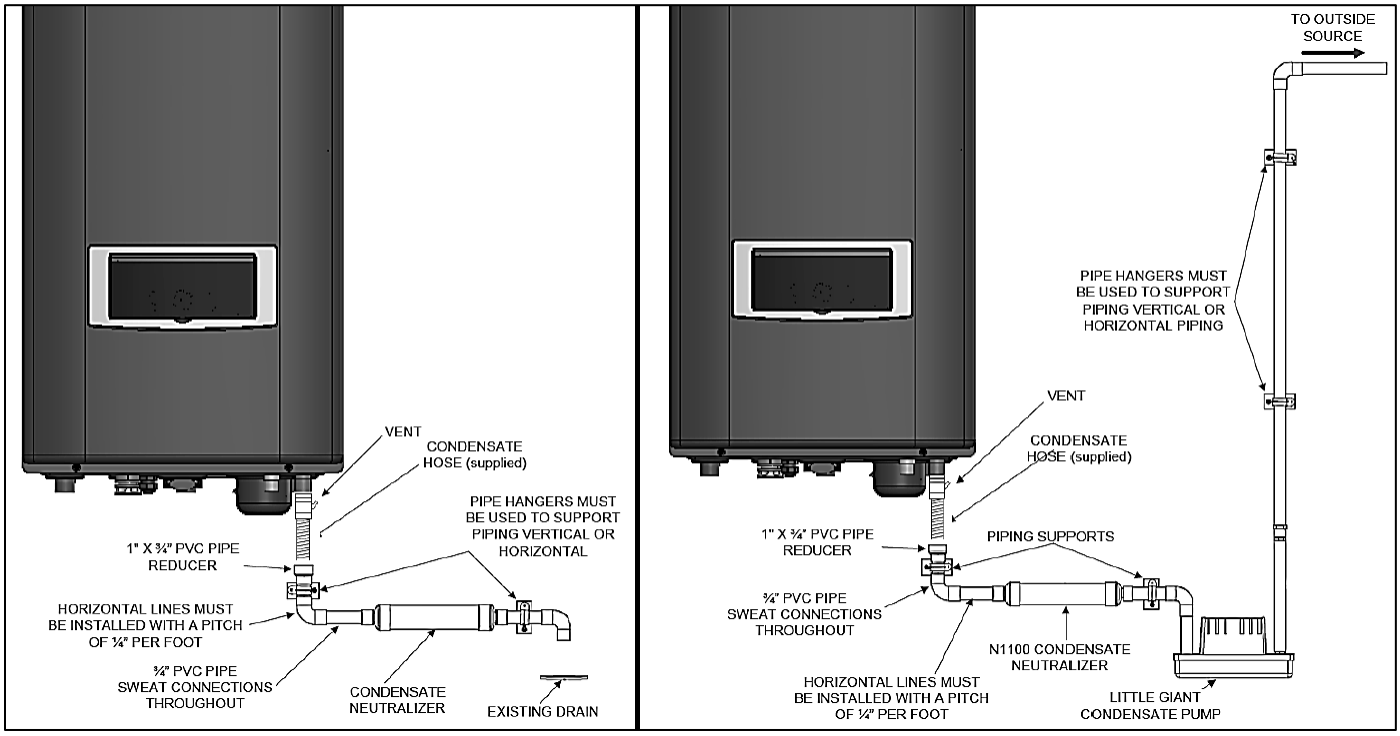


Figure 16 – Condensate Piping with Condensate Neutralizer / Condensate Piping with Condensate Neutralizer and Pump

NOTES:
1. Condensate line must be pitched at least 1/4" per foot to properly drain. If this cannot be done, or a very long length of condensate hose is used, you must increase the condensate line to a minimum of 1" ID and place a tee in the line after the condensate neutralizer to properly reduce vacuum lock in the drain line.
2. Plastic pipe should be the only material used for the condensate line. Steel, brass, copper, or other materials will be subject to corrosion or deterioration.
3. NEVER install condensate lines outside. It is very important that the condensate line is not exposed to freezing temperatures or any type of blockage. Damages due to frozen or blocked condensate lines ARE NOT covered by warranty.
4. Support of the condensate line may be necessary to avoid blockage of the condensate flow.

CAUTION
If using a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage.

CAUTION
It is very important that the condensate piping be no smaller than ¾". To prevent sagging and maintain pitch, condensate piping should be supported with pipe supports, and pitched ¼" per foot to allow for proper drainage.

CAUTION
The condensate line must remain unobstructed, allowing free flow of condensate. If condensate freezes in the line, or if line is obstructed in any other manner, condensate can exit from the tee, resulting in potential water damage to property.

PART 7 – GAS PIPING

⚠ 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.
Always match the boiler with the type of gas supplied to the unit (natural gas or LP gas). Propane ready boilers have the suffix "LP" after the model serial number.
Make sure the gas line pressures are within normal limits. Pressures outside normal limits can result in poor performance and hazardous operating conditions.
Failure to follow these guidelines could result in property damage, personal injury, or death.

A. 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.

Figure 17 – Excess Flow Valve (EFV)

B. GAS PIPE SIZING TABLES

1. Gas Pipe Sizing

This information is for reference use only. Refer to gas pipe manufacturer specifications for actual delivery capacity. The DOE standard for Natural Gas is 1100 BTU/ft^3. Contact the local gas supplier for actual BTU/ft^3 rating.

2. Natural Gas Pipe Sizing

The following tables list maximum capacity of pipe in cubic feet of gas per hour for gas pressures of 14" or less and a pressure drop of 0.5 inches water column, based on a 0.60 specific gravity for natural gas.

Maximum Natural Gas Delivery Capacity – Length of Corrugated Stainless Steel Pipe in Feet										
Pipe Size	**Cubic Feet per Hour (0.60 Specific Gravity, 0.5 WC Pressure Drop)**									
	10	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**150**	**200**
¾"	192	137	112	97	87	80	69	62	48	44
1"	383	269	218	188	168	153	132	118	91	82
1 ¼"	639	456	374	325	292	267	232	208	171	148
1 ½"	1260	888	723	625	559	509	440	393	320	277
2"	2930	2080	1700	1470	1320	1200	1040	933	762	661

Table 11 – Natural Gas Delivery Capacity – Corrugated Stainless Steel Pipe – Refer to ANSI Z223.1 – National Fuel Gas Code, Latest Edition

Maximum Natural Gas Delivery Capacity – Length of Black Iron Pipe (Sch. 40 Metallic) in Feet										
Pipe Size	**Cubic Feet per Hour (0.60 Specific Gravity, 0.5 WC Pressure Drop)**									
	10	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**150**	**200**
¾"	360	247	199	170	151	137	117	104	83	71
1"	678	466	374	320	284	257	220	195	157	134
1 ¼"	1390	957	768	657	583	528	452	400	322	275
1 ½"	2090	1430	1150	985	873	791	677	600	482	412
2"	4020	2760	2220	1900	1680	1520	1300	1160	928	794
2 ½"	6400	4400	3530	3020	2680	2430	2080	1840	1480	1270
3"	11300	7780	6250	5350	4740	4290	3670	3260	2610	2240
4"	23100	15900	12700	10900	9660	8760	7490	6640	5330	4560

Table 12 – Natural Gas Delivery Capacity – Black Iron Pipe – Refer to ANSI Z223.1 – National Fuel Gas Code, Latest Edition

3. LP (Liquid Propane) Gas Pipe Sizing

The following is intended for use for piping between a Single or Second Stage (Low Pressure) Regulator and the appliance. The following tables list maximum capacity of pipe in cubic feet of gas per hour for an inlet pressure of 11 inches water column and specific pressure drop of 0.5 inches water column based on 1.5 specific gravity for liquid propane.

Maximum Liquid Propane Delivery Capacity – Length of Corrugated Stainless Steel Pipe in Feet										
Pipe Size	**Cubic Feet per Hour (0.60 Specific Gravity, 0.5 WC Pressure Drop)**									
	10	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**150**	**200**
¾"	303	216	177	153	137	126	109	98	75	69
1"	605	425	344	297	265	241	208	186	143	129
1 ¼"	971	661	528	449	397	359	307	270	217	183
1 ½"	1990	1400	1140	988	884	805	696	621	506	438
2"	4640	3290	2680	2330	2080	1900	1650	1480	1210	1050

Table 13 – Liquid Propane Delivery Capacity – Corrugated Stainless Steel Pipe – Refer to ANSI Z223.1 – National Fuel Gas Code, Latest Edition

Maximum Liquid Propane Delivery Capacity – Length of Black Iron Pipe (Sch. 40 Metallic) in Feet										
Pipe Size	**Cubic Feet per Hour (0.60 Specific Gravity, 0.5 WC Pressure Drop)**									
	10	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**150**	**200**
¾"	608	418	336	287	255	231	212	197	175	140
1"	1150	787	632	541	480	434	400	372	330	265
1 ¼"	2350	1620	1300	1110	985	892	821	763	677	543
1 ½"	3520	2420	1940	1660	1480	1340	1230	1140	1010	814
2"	6790	4660	3750	3210	2840	2570	2370	2200	1950	1570

Table 14 – Liquid Propane Delivery Capacity – Black Iron Pipe – Refer to ANSI Z223.1 – National Fuel Gas Code, Latest Edition

C. GAS CONNECTION REQUIREMENTS

1. The gas connection fitting on the appliance is ¾" female NPT. **NOTE:** The pipe size must not be less than ¾".

2. The supply line must be sized for the maximum output of the appliance being installed. If there are additional gas appliances from the main supply line, measure the size of the supply line according to the COMBINED total maximum BTUH draw for the appliances as if they were operating at the same time.

3. Measure the length of the gas supply line from the gas meter to the appliance. Appliance must be installed downstream of the gas meter to ensure adequate gas supply. Use the tables in this manual or refer to the gas line manufacturer's sizing information to determine the correct supply pipe size.

4. A manual gas shut-off valve should be installed in the gas supply line close to the appliance. See Figure 18 for detail.

5. To facilitate any future maintenance, it is also recommended that an approved gas union fitting be installed in the supply line between the shut-off valve and the ¾" female NPT connection on the appliance.

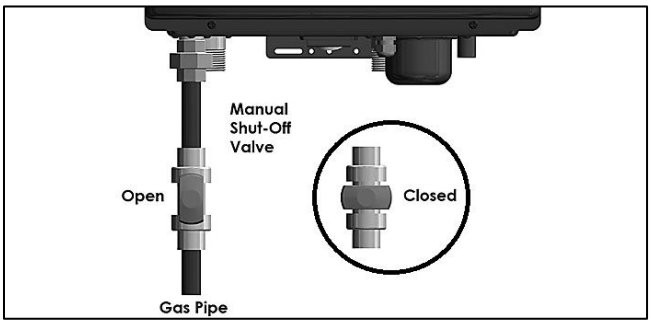


Figure 18 – Gas Line with Shut-Off Valve Detail

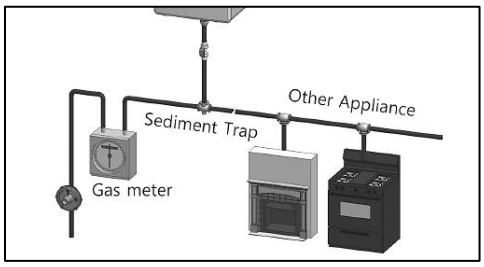


Figure 19 – Natural Gas Piping Installation – NOTE: Capacity to be Not Less than Total Capacity of Connected Boilers

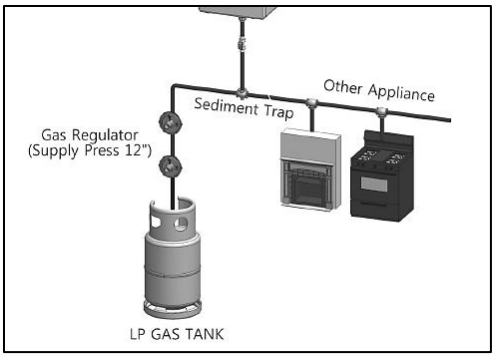


Figure 20 – LP Gas Piping Installation – NOTE: Capacity to be Not Less than Total Capacity of Connected Boilers

PART 8 – WATER PIPING

A. GENERAL PLUMBING CONNECTION GUIDELINES

- 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.
- Do not apply a torch within 12" of the boiler. Doing so could damage the boiler. Such damages ARE NOT covered by product warranty.
- See Tables 16 and 17 for **minimum** CH pipe sizing.
- To ease future maintenance isolation valves are recommended on both the CH and DHW loops.
- All piping should be insulated.

CAUTION
Use at least the MINIMUM pipe size for connecting the boiler. Failure to follow these guidelines could result in system problems, increased installation cost, and possible boiler failure. **SUCH COSTS AND FAILURES ARE NOT COVERED BY WARRANTY.**

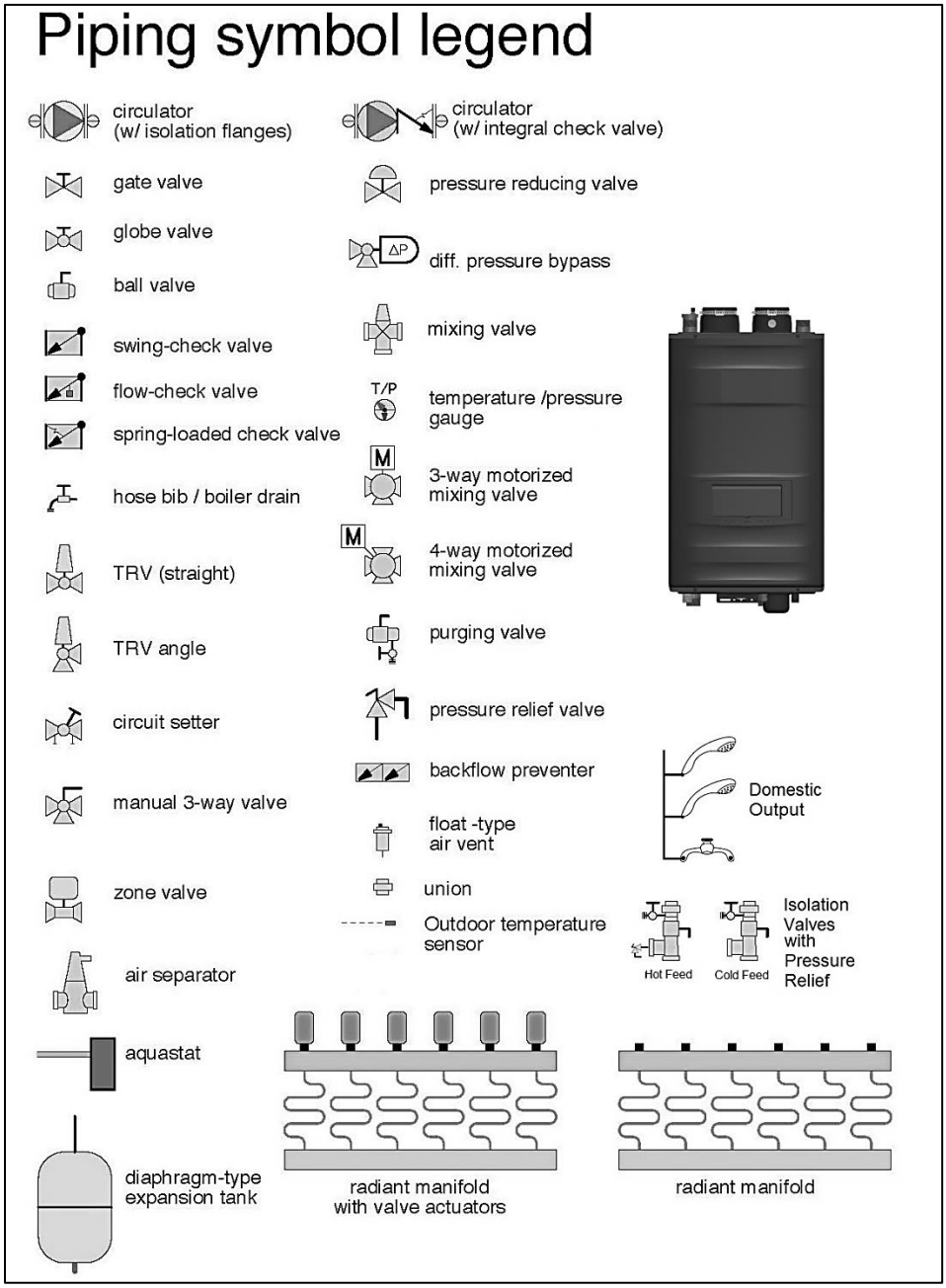


Figure 21 – Piping Legend

B. BACKFLOW PREVENTER

It may be recommended to use a back flow preventer – check local codes. If a back flow preventer or a no return valve is used, a thermal expansion tank must be installed on the cold water supply between the boiler and valve.

⚠ WARNING

To control thermal expansion, a thermal expansion tank suitable for potable water should be installed in systems with an installed backflow preventer. DO NOT use a closed type expansion tank. Follow expansion tank manufacturer's specifications to properly size an expansion tank to the installation. Failure to properly accommodate thermal expansion could result in property damage, severe personal injury, or death.

C. CENTRAL HEATING PIPING SYSTEM WATER PIPING METHODS

EXPANSION TANK AND MAKE-UP WATER

1. Ensure that the expansion tank is designed and sized to correctly handle system water volume and temperature. Check technical specifications for water content of this boiler.

⚠ 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 system expansion could result in wasted time, money, and possible property damage, personal 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.**

2. The expansion tank must be located following recognized design methods. See expansion tank manufacturer's instructions for details.

3. Connect the expansion tank to the air separator only if the air 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.

⚠ CAUTION

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.

DIAPHRAGM (OR BLADDER) EXPANSION TANK

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

Use both thread tape and pipe dope to connect to the 1 ¼" heating water outlet and inlet.

D. CIRCULATOR SIZING

The heat exchanger has a pressure drop that must be considered in your system design. Refer to Table 15 for pressure drop through the heat exchanger.

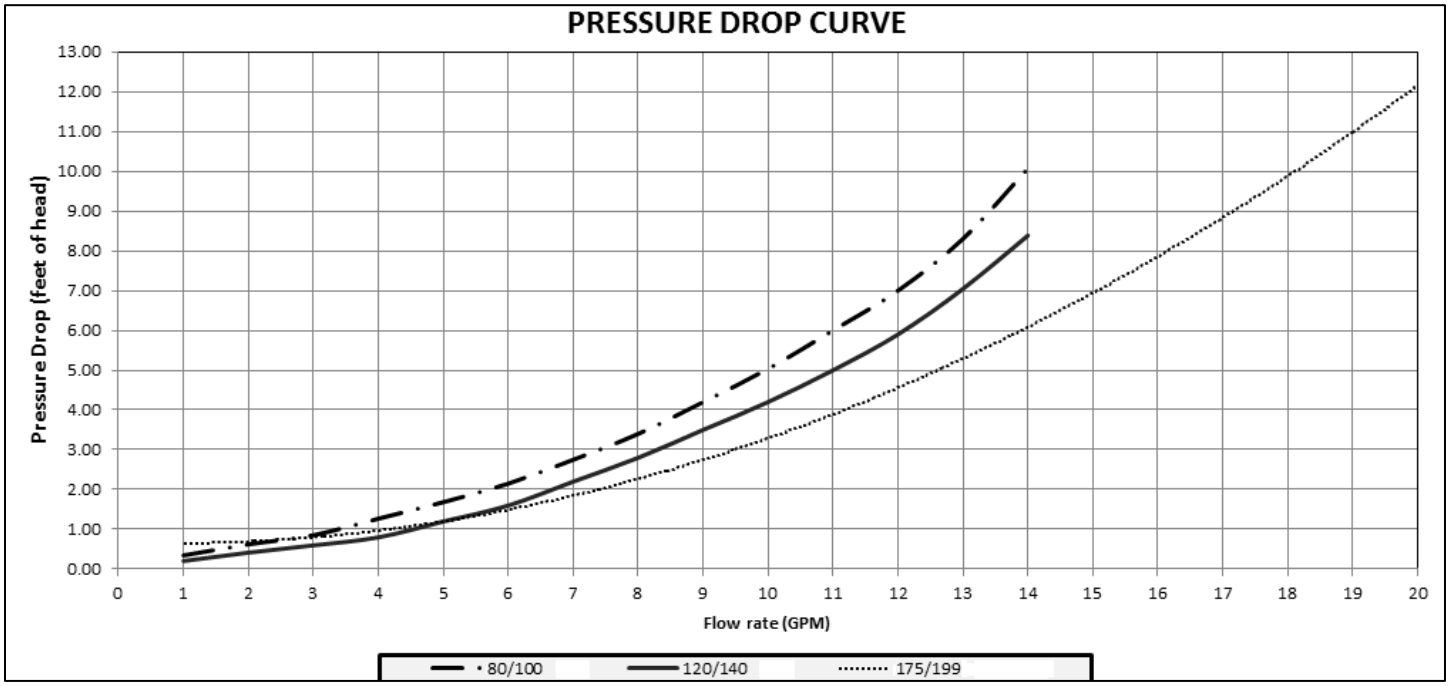


Table 15 – Pressure Drop through the Heat Exchanger

The chart below represents the various system design temperature rise through the boiler along with their respective flows and friction loss, which will aid in circulator selection.

SYSTEM TEMPERATURE RISE CHART							
MODEL	Minimum Pipe Size	20°F ΔT		30°F ΔT		40°F ΔT	
		Flow Rate (GPM)	Head (FT)	Flow Rate (GPM)	Head (FT)	Flow Rate (GPM)	Head (FT)
80W	1"	7.6	3.1	5.1	1.8	3.8	1.2
100W		9.5	4.7	6.3	2.3	4.8	1.7
120W		11.4	5.4	7.6	2.5	5.7	1.6
140W		13.3	7.3	8.9	3.5	6.7	2.1
175W	1 ¼"	16.6	8.5	11.1	4.0	8.3	2.5
199W		18.9	11.0	12.6	5.0	9.5	3.0

Table 16 – Boiler Flow Rates

MODEL	Number of Units Cascaded						
	2	3	4	5	6	7	8
80W	1 ¼"	1 ¼"	1 ½"	2"	2"	2"	3"
100W	1 ¼"	1 ¼"	2"	2"	2"	3"	3"
120W	1 ¼"	1 ½"	2"	2"	3"	3"	3"
140W	1 ½"	1 ½"	2"	3"	3"	3"	3"
175W	1 ½"	1 ½"	3"	3"	3"	3"	3"
199W	2"	2"	3"	3"	3"	3"	4"

Table 17 – Manifold Pipe Sizes in Inches – NOTE: The above pipe sizes are based on 20°F Delta and maximum water velocity between 5 - 6 ft/s

CAUTION

When installing a cascaded system, it is important that the boilers are the same model. Failure to ensure the boilers are the same model will result in improper system operation, wasted time, money, and possible property damage and personal injury. Such damages ARE NOT covered by product warranty.

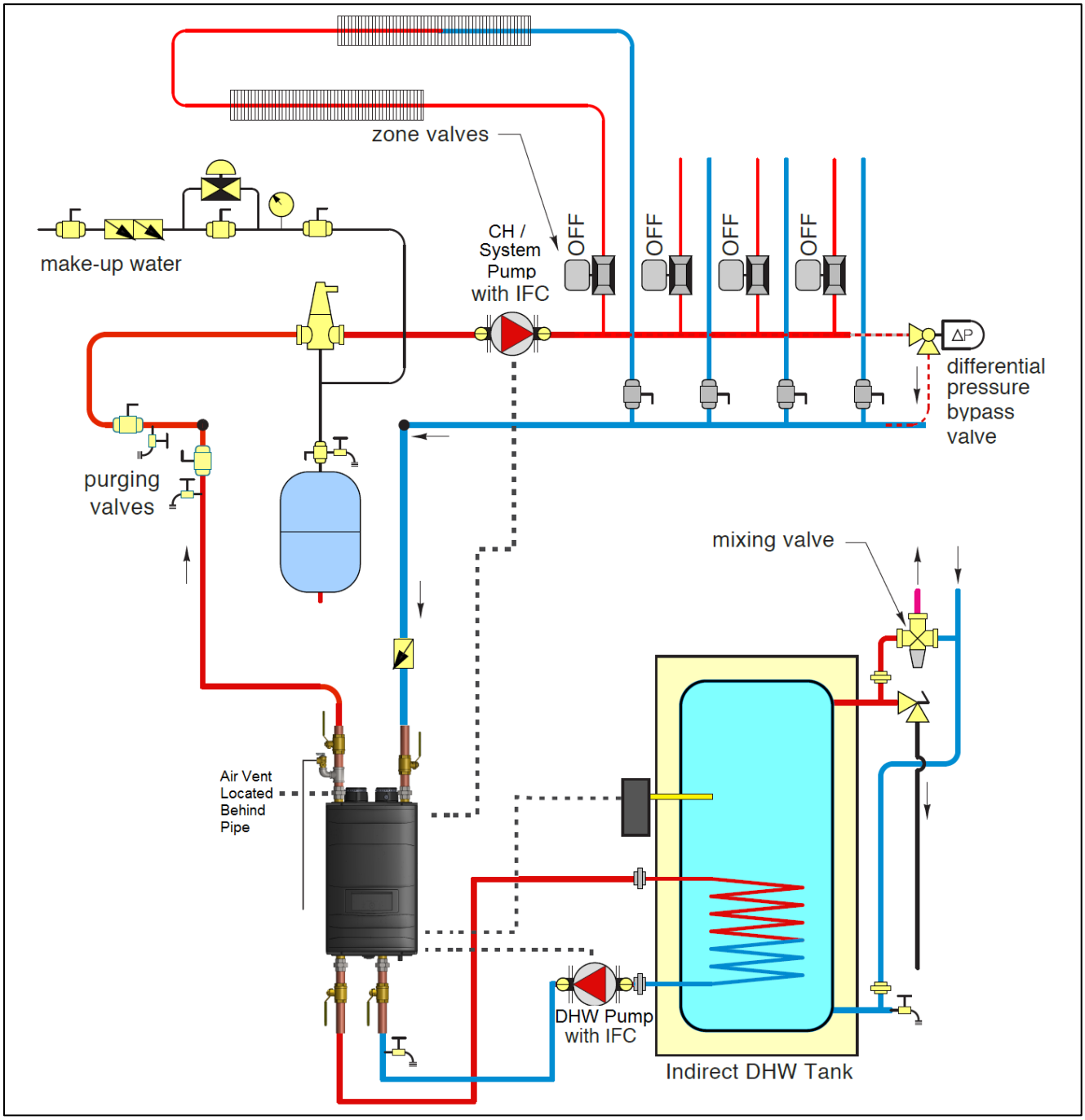


Figure 22 – Zoning with Zone Valves and Indirect Water Heating – Direct Piping

NOTES:

1. This drawing is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be within 4 pipe diameters center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. See Table 16 for **minimum** CH pipe sizing.
5. Circulators are shown with isolation flanges. The alternative is standard flanges with full port ball valves. Purge valves can be used with circulator flanges as an alternative.
6. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
7. **VERY IMPORTANT** – Minimum flow rates outlined in this manual must be maintained through the heat exchanger to minimize short cycling.
8. In a valve-based system, each heating zone has a zone valve which opens when that zone calls for heat. Each zone thermostat is wired to its corresponding zone valve. Contacts in the zone valves provide a signal to the boiler to operate when there is a call for heat.
9. Install a check valve on the return line to the boiler.

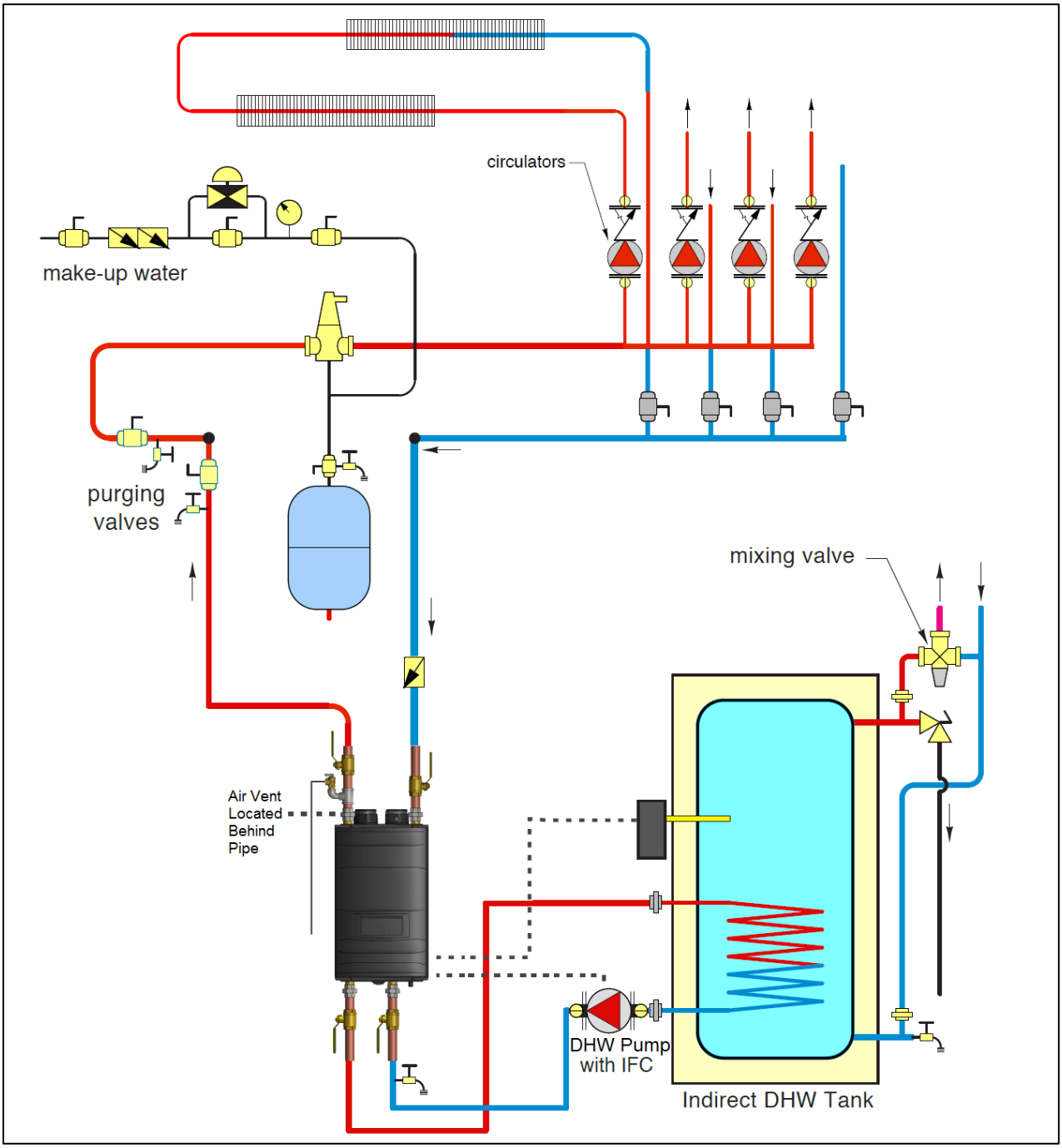


Figure 23 – Zoning with Pumps and Indirect Fired Water Heater – Direct Piping

NOTES:
1. This drawing is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be within 4 pipe diameters center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. The **minimum** pipe size of DHW piping should be ¾" diameter. See Table 16 for **minimum** CH pipe sizing.
5. Circulators are shown with isolation flanges. The alternative is standard flanges with full port ball valves. Purge valves can be used with circulator flanges as an alternative.
6. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
7. **VERY IMPORTANT** – Minimum flow rates outlined in this manual must be maintained through the heat exchanger to minimize short cycling.
8. Each heating zone of a pump-based system has its own circulator with turns on when a zone thermostat calls for heat.
9. Install a check valve on the return line to the boiler.

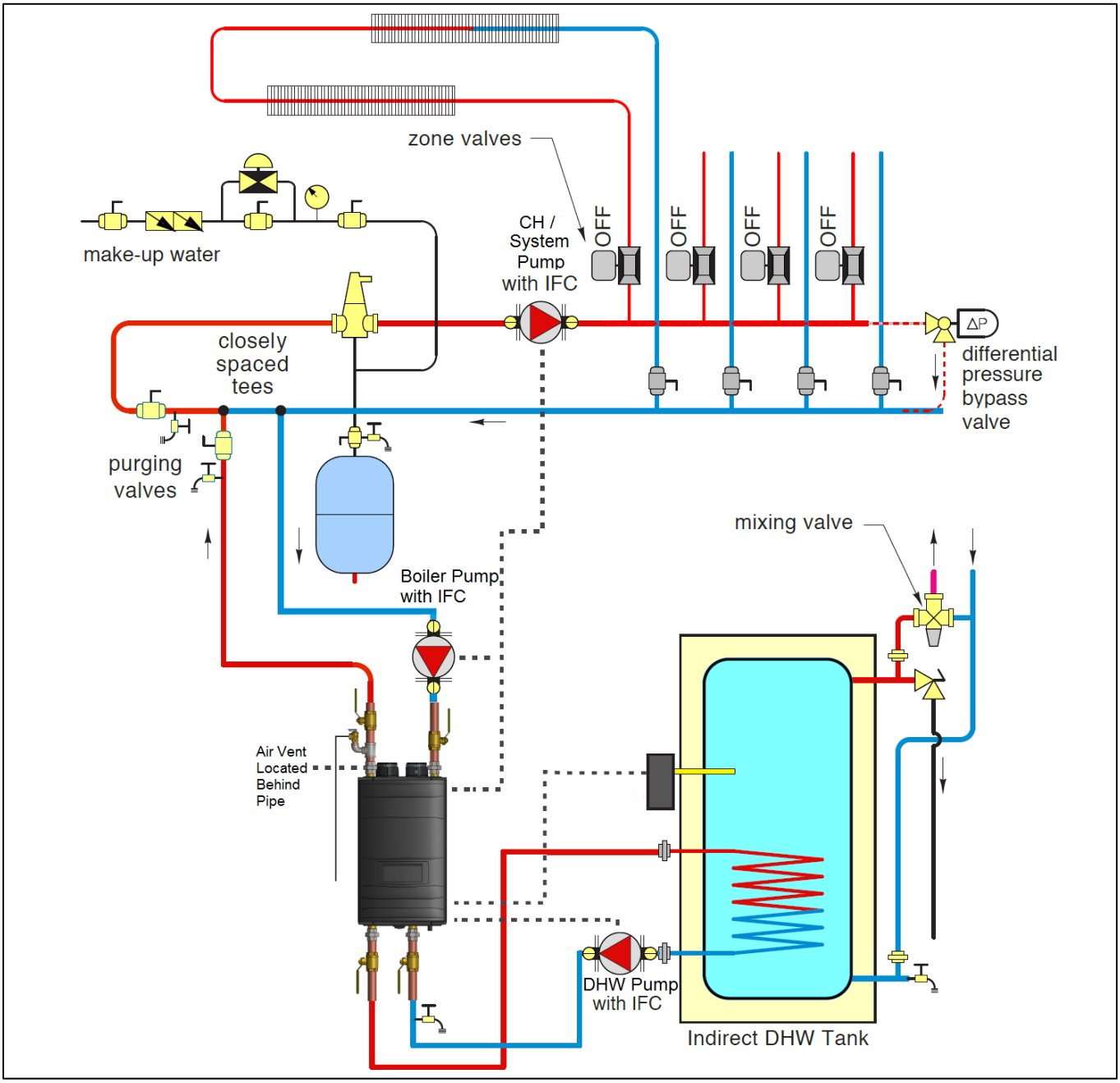


Figure 24 – Zoning with Zone Valves and Indirect Water Heating – Primary / Secondary Shown

NOTES:

1. This drawing is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be within 4 pipe diameters center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. See Table 16 for **minimum** CH pipe sizing.
5. Circulators are shown with isolation flanges. The alternative is standard flanges with full port ball valves. Purge valves can be used with circulator flanges as an alternative.
6. Piping shown is Primary/Secondary. System flow (secondary loop) must be greater than the boiler's primary loop flow.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
8. **VERY IMPORTANT** – Minimum flow rates outlined in this manual must be maintained through the heat exchanger to minimize short cycling.
9. In a valve-based system, each heating zone has a zone valve which opens when that zone calls for heat. Each zone thermostat is wired to its corresponding zone valve. Contacts in the zone valves provide a signal to the boiler to operate when there is a call for heat.
10. If Boiler Pump on the return line does not have an internal flow check, install a check valve on the return line to the boiler.

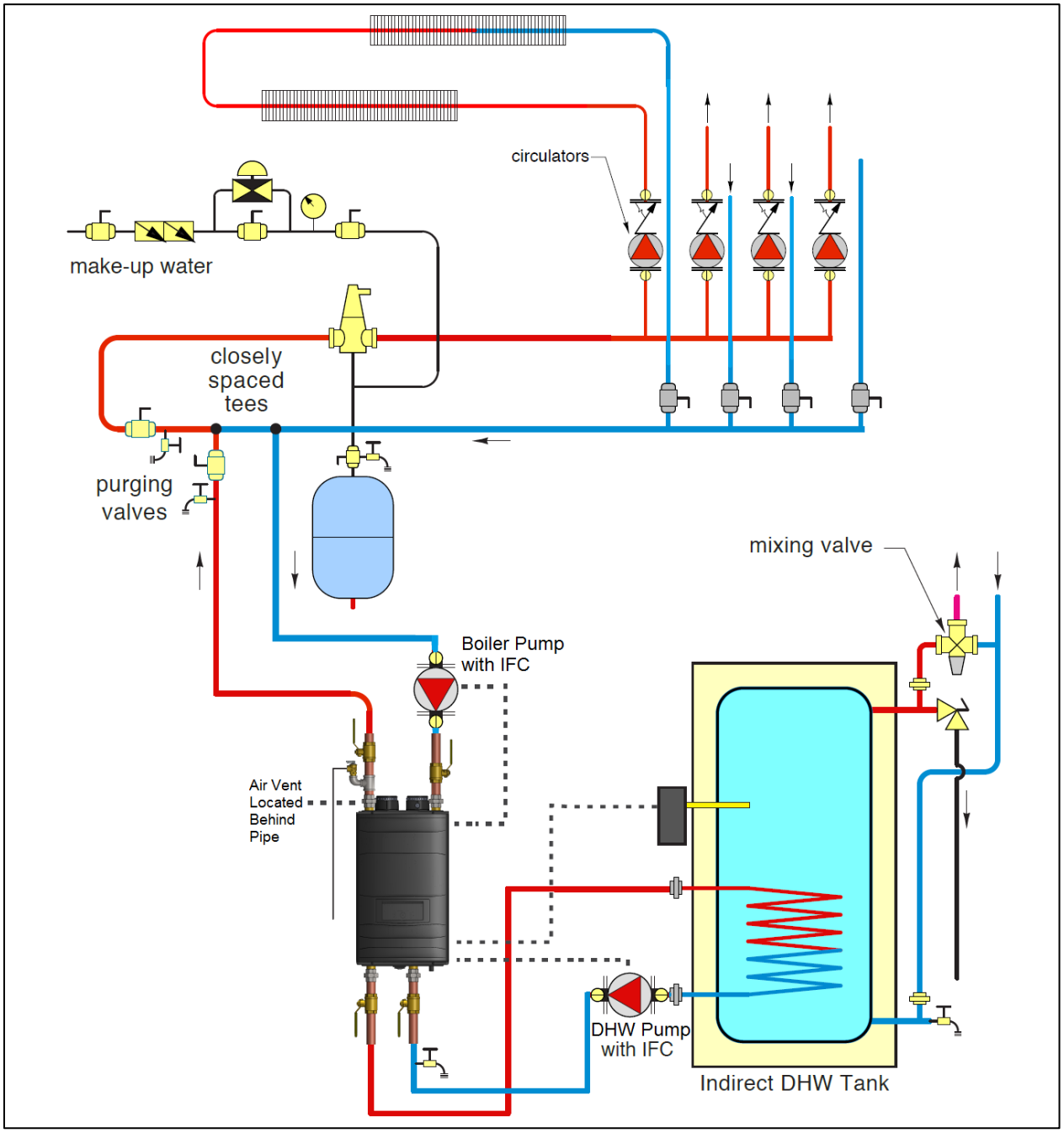


Figure 25 – Zoning with Pumps and Indirect Fired Water Heater – Primary/Secondary Shown

NOTES:
1. This drawing is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be within 4 pipe diameters center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. The **minimum** pipe size of DHW piping should be ¾" diameter. See Table 16 for **minimum** CH pipe sizing.
5. Circulators are shown with isolation flanges. The alternative is standard flanges with full port ball valves. Purge valves can be used with circulator flanges as an alternative.
6. Piping shown is Primary/Secondary. System flow (secondary loop) must be greater than the boiler's primary loop flow.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
8. **VERY IMPORTANT** – Minimum flow rates outlined in this manual must be maintained through the heat exchanger to minimize short cycling.
9. Each heating zone of a pump-based system has its own circulator with turns on when a zone thermostat calls for heat.
10. If Boiler Pump on the return line does not have an internal flow check, install a check valve on the return line to the boiler.

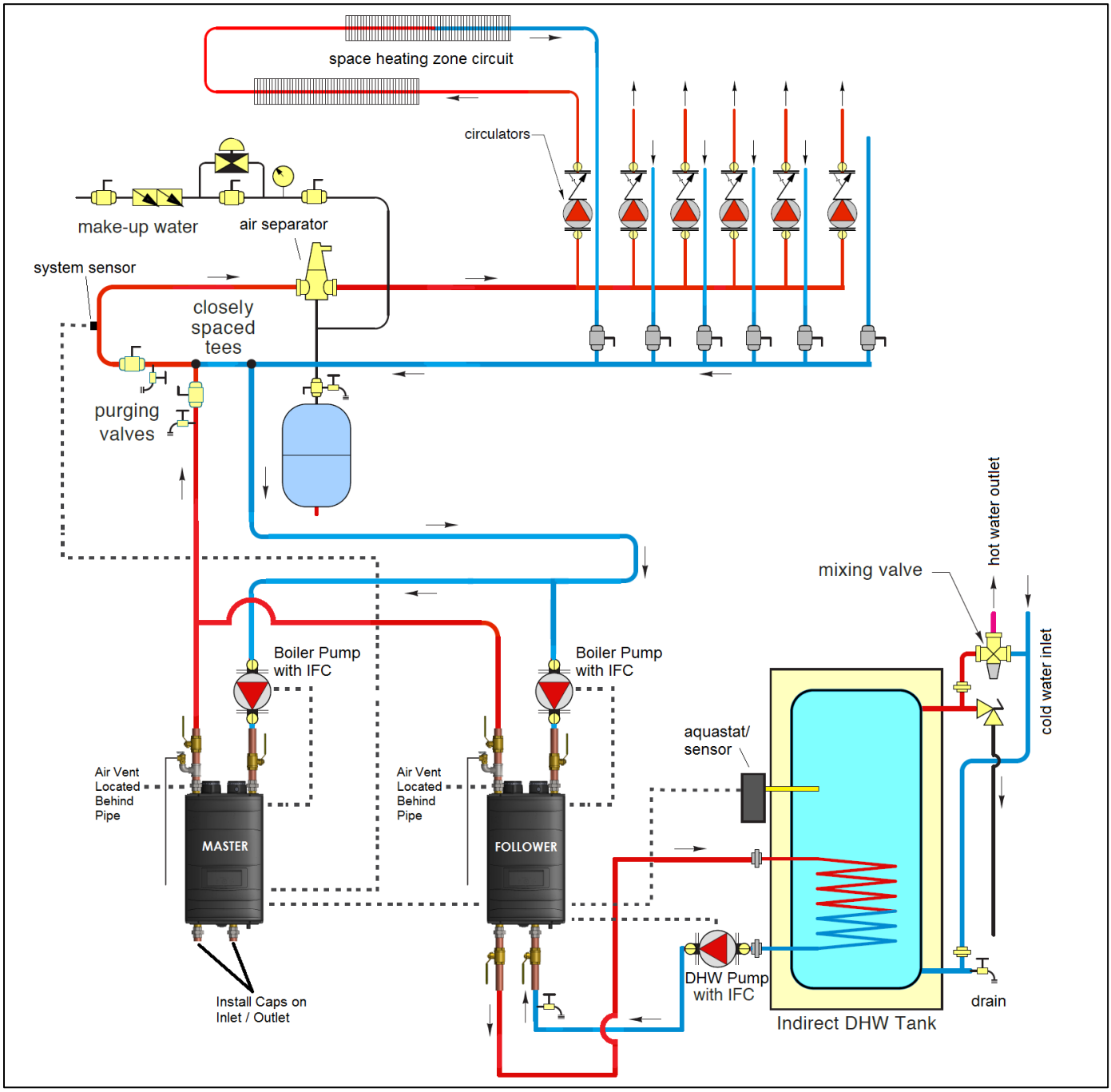


Figure 26 – Cascaded System - Zoning with Pumps and Indirect Fired Water Heater – Primary/Secondary Shown

NOTES:

1. This drawing is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be within 4 pipe diameters center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. The **minimum** pipe size of DHW piping should be ¾" diameter. See Tables 16 and 17 for **minimum** CH pipe sizing.
5. Circulators are shown with isolation flanges. The alternative is standard flanges with full port ball valves. Purge valves can be used with circulator flanges as an alternative.
6. Piping shown is Primary/Secondary. System flow (secondary loop) must be greater than the boiler's primary loop flow.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
8. **VERY IMPORTANT** – Minimum flow rates outlined in this manual must be maintained through the heat exchanger to minimize short cycling.
9. Each heating zone of a pump-based system has its own circulator with turns on when a zone thermostat calls for heat.
10. If Boiler Pump on the return line does not have an internal flow check, install a check valve on the return line to the boiler.

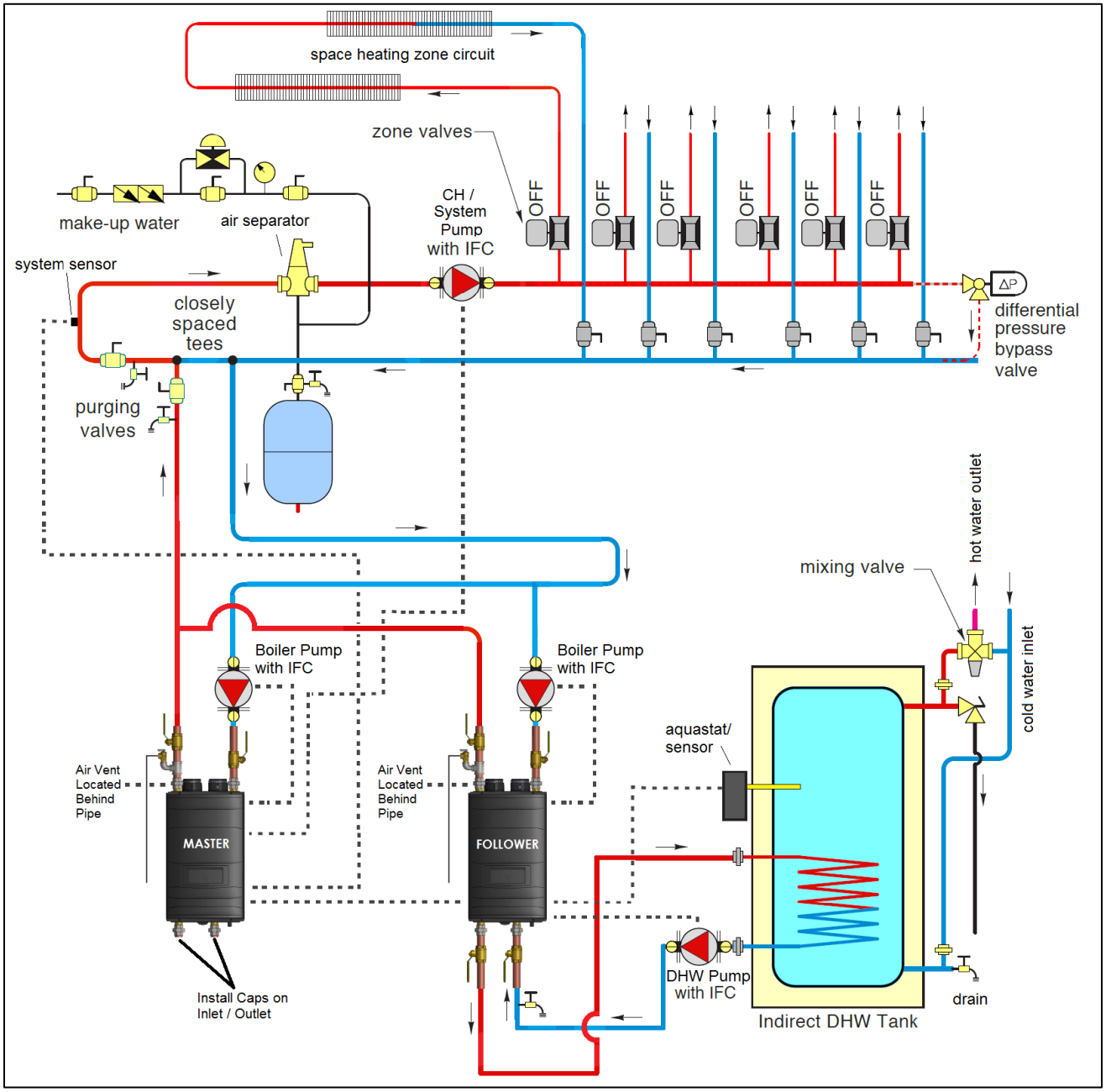


Figure 27 – Cascaded System - Zoning with Zone Valves and Indirect Water Heating – Primary / Secondary Shown

NOTES:

1. This drawing is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be within 4 pipe diameters center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. See Tables 16 and 17 for **minimum** CH pipe sizing.
5. Circulators are shown with isolation flanges. The alternative is standard flanges with full port ball valves. Purge valves can be used with circulator flanges as an alternative.
6. Piping shown is Primary/Secondary. System flow (secondary loop) must be greater than the boiler's primary loop flow.
7. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
8. **VERY IMPORTANT** – Minimum flow rates outlined in this manual must be maintained through the heat exchanger to minimize short cycling.
9. In a valve-based system, each heating zone has a zone valve which opens when that zone calls for heat. Each zone thermostat is wired to its corresponding zone valve. Contacts in the zone valves provide a signal to the boiler to operate when there is a call for heat.
10. If Boiler Pump on the return line does not have an internal flow check, install a check valve on the return line to the boiler.

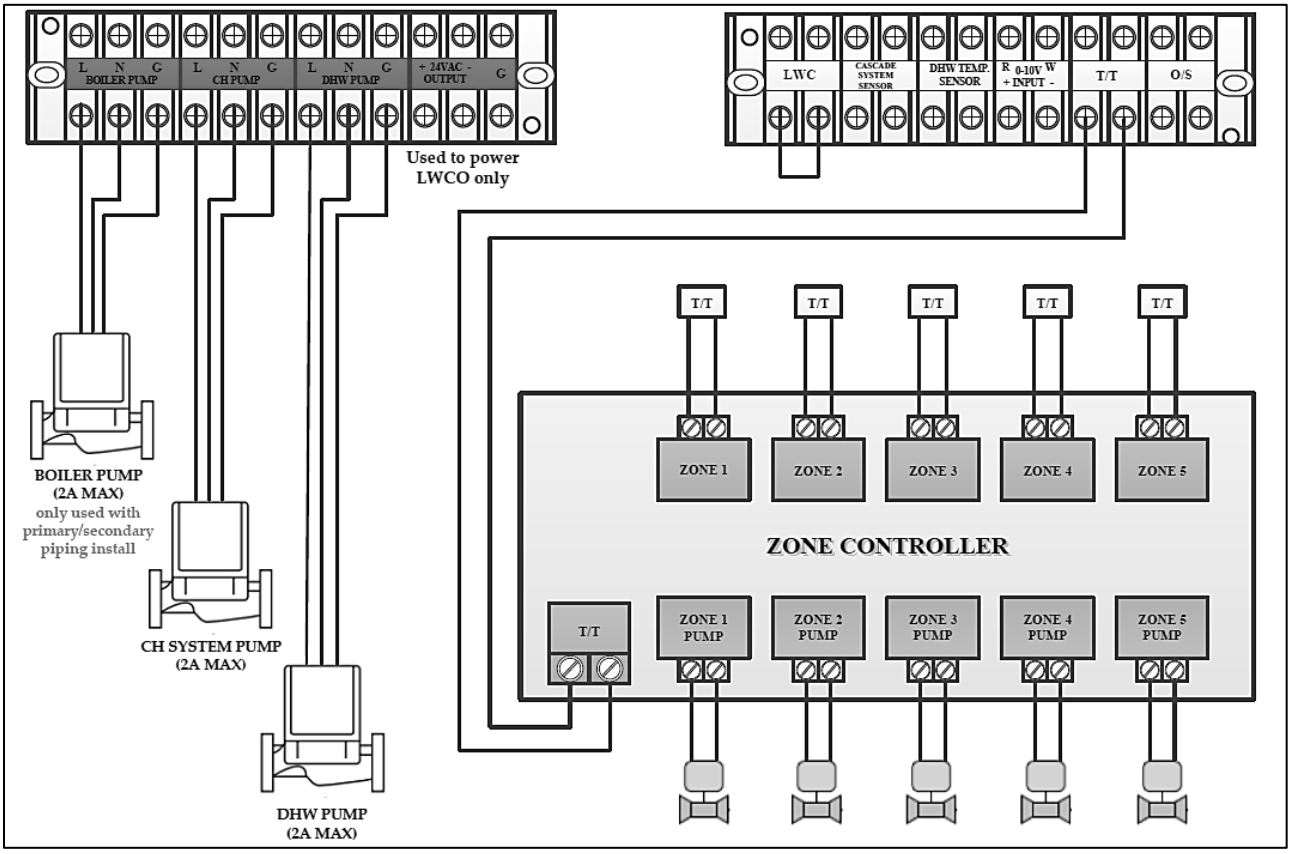


Figure 28 – Wiring – Zoning with Zone Valves and Indirect Water Heating

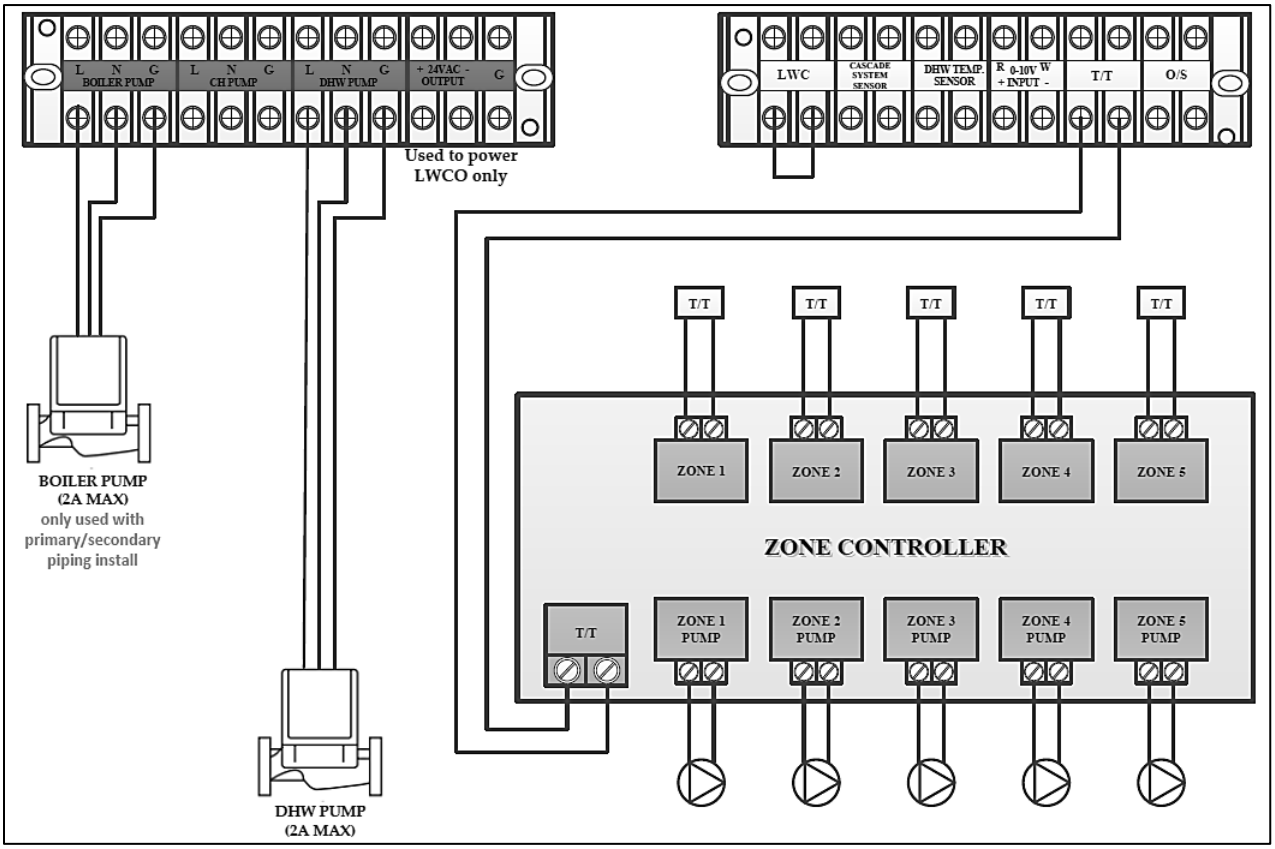


Figure 29 – Wiring – Zoning with Pumps and Indirect Water Heating

E. CH PRESSURE RELIEF VALVE

An external pressure relief valve is provided with this boiler. The pressure relief valve MUST BE installed. When installing, observe the following guidelines. The pressure relief valve must be installed as close to the boiler as possible. No other valves should be placed between the pressure relief valve and the boiler. Failure to comply with these guidelines can result in substantial property damage, personal injury, or death.

This boiler has a high-temperature shut-off switch built in as a standard safety feature. Therefore, a "pressure only" relief valve is required. DO NOT operate this boiler before the supplied pressure relief valve is installed with sufficient relieving capacity in accordance with the ASME rating plate on the boiler.

CH Loop

This boiler is provided with a CH pressure relief valve that complies with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV (Heating Boilers). The included 30 psi CH Pressure Relief Valve must be installed on the CH supply line to ensure a compliant installation and safe operation. HTP has supplied fittings to aid installation of the CH Pressure Relief Valve. The valve is meant to be field installed. DO NOT install a CH pipe line relief valve with a pressure rating greater than 30 psi. This is the maximum allowable CH relief valve setting for this boiler.

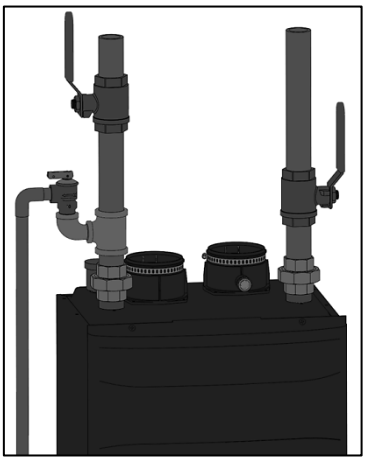


Figure 30 – Pressure Relief Valve

⚠ WARNING

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 relief line cannot be in contact with any live electrical parts.
- 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 shutoff 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, replace it with a new 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.
- For boilers installed with only a pressure relief valve, the separate storage vessel must have a temperature and pressure relief valve installed. This relief valve shall comply with *Relief Valves for Hot Water Supply Systems, ANSI Z21.22 CSA4.4.*

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.

F. BUILT-IN LOW WATER CUT-OFF (LWCO)

NOTE: This boiler is equipped with a low water cut-off (LWCO) probe. When this LWCO senses low water level, boiler operation will cease and Er:80 will appear on the display panel. Er:80 will clear and boiler operation will resume when the low water condition is remedied. Local codes or jurisdictions may accept this control function as a means of providing low water protection.

G. OPTIONAL EXTERNAL UL353 MANUAL RESET LOW WATER CUT-OFF (LWCO) INTERFACE KIT

HTP offers an optional External UL 353 Manual Reset Low Water Cut-Off (LWCO) Interface Kit if a UL 353 LWCO is required by local codes. The LWCO should be mounted into a tee as detailed in Figure 31. It should then be wired into the boiler as described in Figure 32. Remove the jumper from the LWCO relay connection when installing.

Follow the complete instructions included in the kit for proper installation.

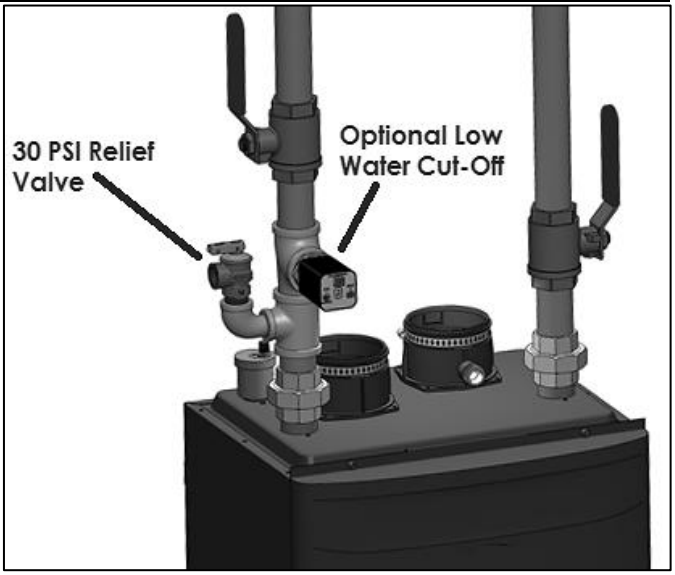


Figure 31 – Relief Valve Details

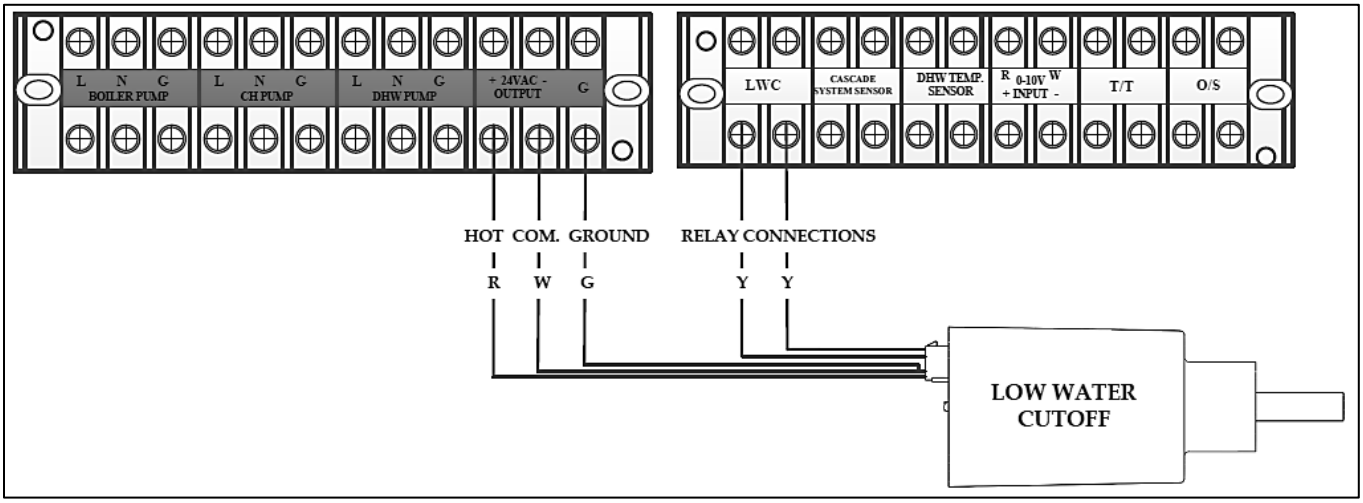


Figure 32 – Wiring External LWCO to the Boiler

PART 9 – CONNECT ELECTRICAL POWER / INITIAL STARTUP

⚠ 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.

⚠ WARNING

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.

A. GENERAL OPERATING CONDITIONS

- Temperature
  - Operating Ambient Temperature Range: 14 – 140°F (-10 to 60°C)
  - Operating Relative Humidity: Up to 90% at 104°F (40°C)

B. WIRING INFORMATION

1. This boiler must be properly grounded. Ensure the electrical outlet (120V / 15 Amp minimum) that the boiler will be plugged into is properly grounded.

2. Do not attach the ground wire to either the gas or water piping as plastic pipe or dielectric unions may isolate the boiler electrically.

⚠ WARNING

This boiler is equipped with a three prong plug. It should only be plugged directly into a properly grounded three prong receptacle. DO NOT remove the ground plug from the plug. Doing so could result in property damage, serious personal injury, or death.

3. The wiring diagrams contained in this manual are to be used for reference purposes only.

4. Refer to these diagrams and the wiring diagrams of any external controls used with the installation when wiring the boiler. Read, understand, and follow all wiring instructions supplied with the controls.

5. Do not disconnect the power supply when the boiler is in normal operation.

6. Freeze related damage IS NOT covered under warranty.

NOTE: For additional electrical protection, the use of a surge protector is recommended. Damage caused by power surges is not covered by the warranty.

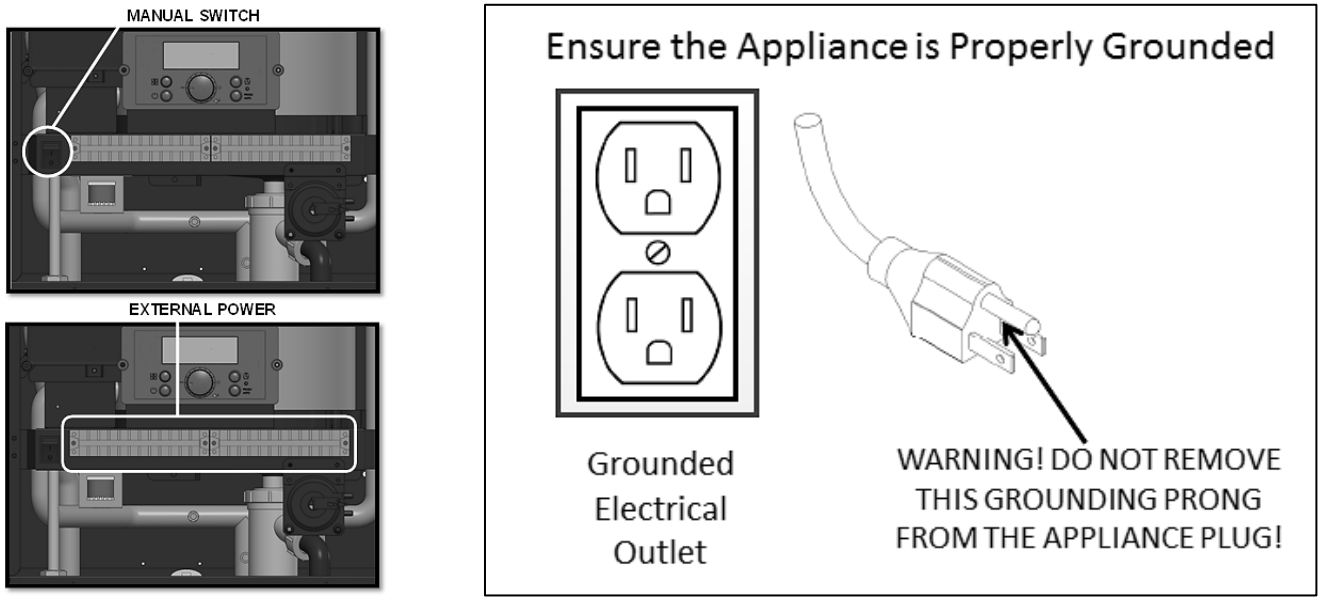


Figure 33 – Manual Power Switch and Boiler Plug Details

NOTICE

If the boiler display does not come ON, first check the plug. Then check the electrical panel circuit breaker and reset it if necessary. If the circuit breaker trips again, do not reset. Disconnect the plug and have a qualified technician diagnose the problem.

C. DIP SWITCHES

There is one set of DIP switches. The boiler is default set at the factory to operate on Natural Gas with a 3" vent.

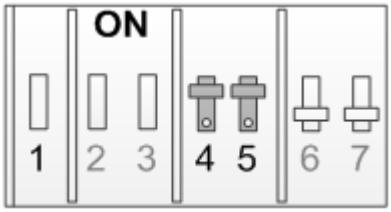


Figure 34 – Factory Default Dip Switch Detail

DIP SWITCH GROUP

DIP SWITCH		OFF	ON
1 - 3	NOT USED	NOT USED	
4	Vent Size	2"	3"
5	Gas Type	LP	NG
6	High Fire	Normal Operation	High Fire
7	Low Fire	Normal Operation	Low Fire

Table 18 – DIP Switches 4 - 7

SYSTEM CONTROL SETTINGS

MAXIMUM FLAME DETECTING VOLTAGE	2.4V
PRE-PURGE TIME (Tp)	Maximum 10 seconds, minimum 1 second
SAFETY TIME (IGNITING TIME) (Ts)	3.5 seconds
IGNITING INTERVAL TIME	20 seconds
POST-PURGE TIME (Tip)	3 minutes (1^{st}: 1 minute, 2^{nd}: 2 minute)
OVER-HEATING 1,2,3 PROTECTION DETECTION TIME	<3 seconds
PUMP 1 POST CIRCULATING TIME (T1pv)	1 minute
PUMP 2 POST CIRCULATING TIME (T2pv)	1 minute
HIGH AND LOW WATER LEVEL DETECTION TIME	<6 seconds
HIGH AND LOW WATER LEVEL RECOVERY TIME	<6 seconds

Table 19 – System Control Settings

D. WIRING A CASCADE SYSTEM

When wiring the boilers for Cascade operation, select one boiler as the Master boiler. The remaining boilers will be designated Followers. See “Setting Up a Cascade System” for more details.

Connect the system sensor and outdoor sensor/0-10V (if used) to the Master boiler. For the Cascade System to work properly the system sensor must be installed. The location of the system sensor should be downstream of the boiler connections in the main system loop. The system sensor should be wired to the low voltage terminal strip marked for the system sensor. The Master control will use the water temperature at the system sensor to control operation of the Cascade System.

If outdoor reset/0-10V is used, the outdoor sensor/0-10V should be wired to the low voltage terminal strip marked for the outdoor sensor/0-10V. If the outdoor sensor/0-10V is connected, the Master control will calculate the water temperature set point based on the programmed reset curve parameters. If the outdoor sensor/0-10V is not connected the Master control will maintain the fixed water temperature set point programmed into the control.

1. Connect the cascade communication cables to every unit. See Figure 35. Add resistor to the end of the last follower.

Every cable comes with one resistor. Use only one resistor on the cascaded system. Discard the rest.

2. Connect the system sensor to the Master low voltage terminal strip. See Figure 40. Thermostat, 0-10V, and Outdoor Sensor must be connected to the Master only.

NOTE: When using an outdoor sensor, the boiler’s CH target will default to 20^{o}F higher than the system sensor target temperature to 180^{o}F.

NOTE: The DHW sensor / aquastat must be connected to the prioritized Follower boiler. When using more than one cascaded boiler for DHW priority, an aquastat must be used and wired in parallel to each boiler used for DHW priority.

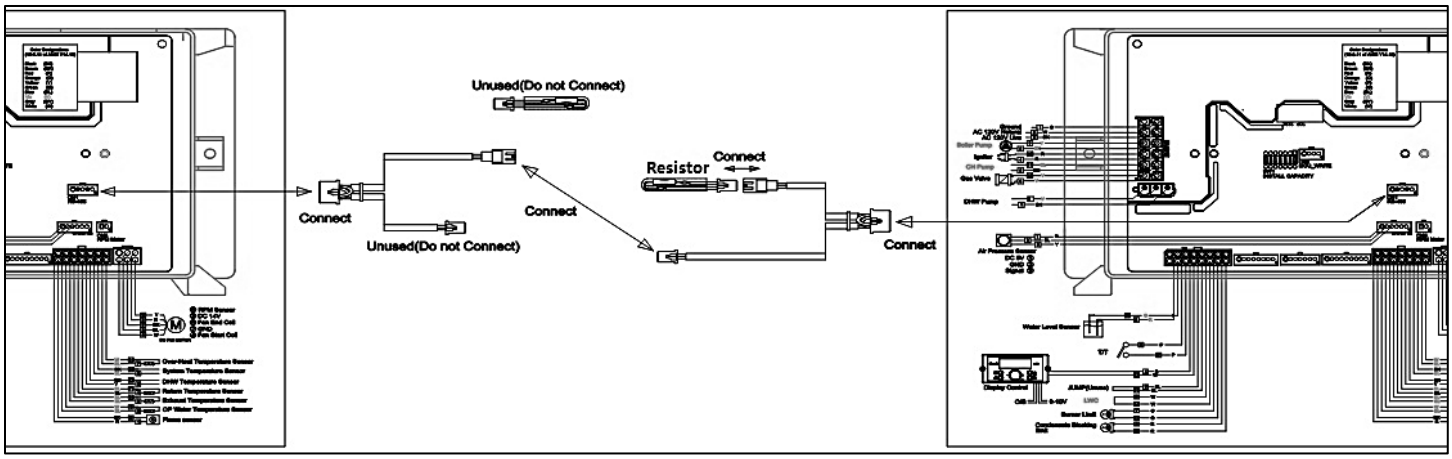


Figure 35 – Example of Cascade Wiring

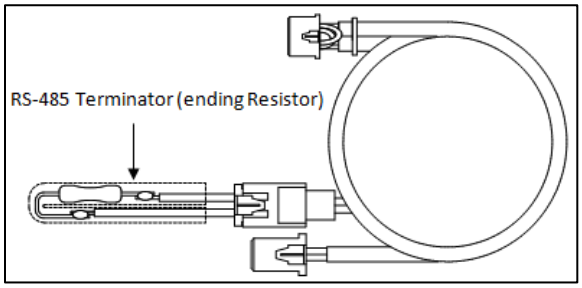


Figure 36 – Installed Resistor

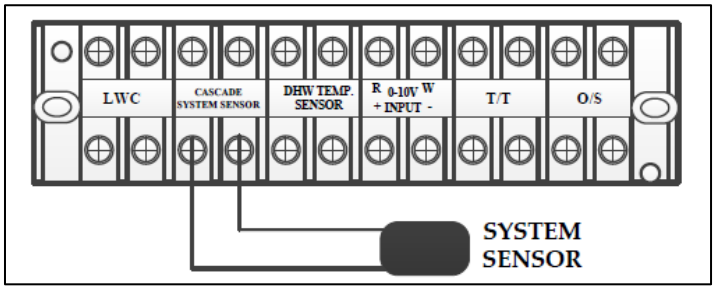


Figure 37 – Wired System Sensor

CAUTION
When installing a cascaded system, it is important that the boilers are the same model.
When selecting more than one boiler for DHW priority in a cascade loop, an aquastat must be used, and connected in parallel to each boiler used for DHW priority.
Failure to follow these instructions will result in improper system operation, wasted time, money, and possible property damage and personal injury. Such damages ARE NOT covered by product warranty.

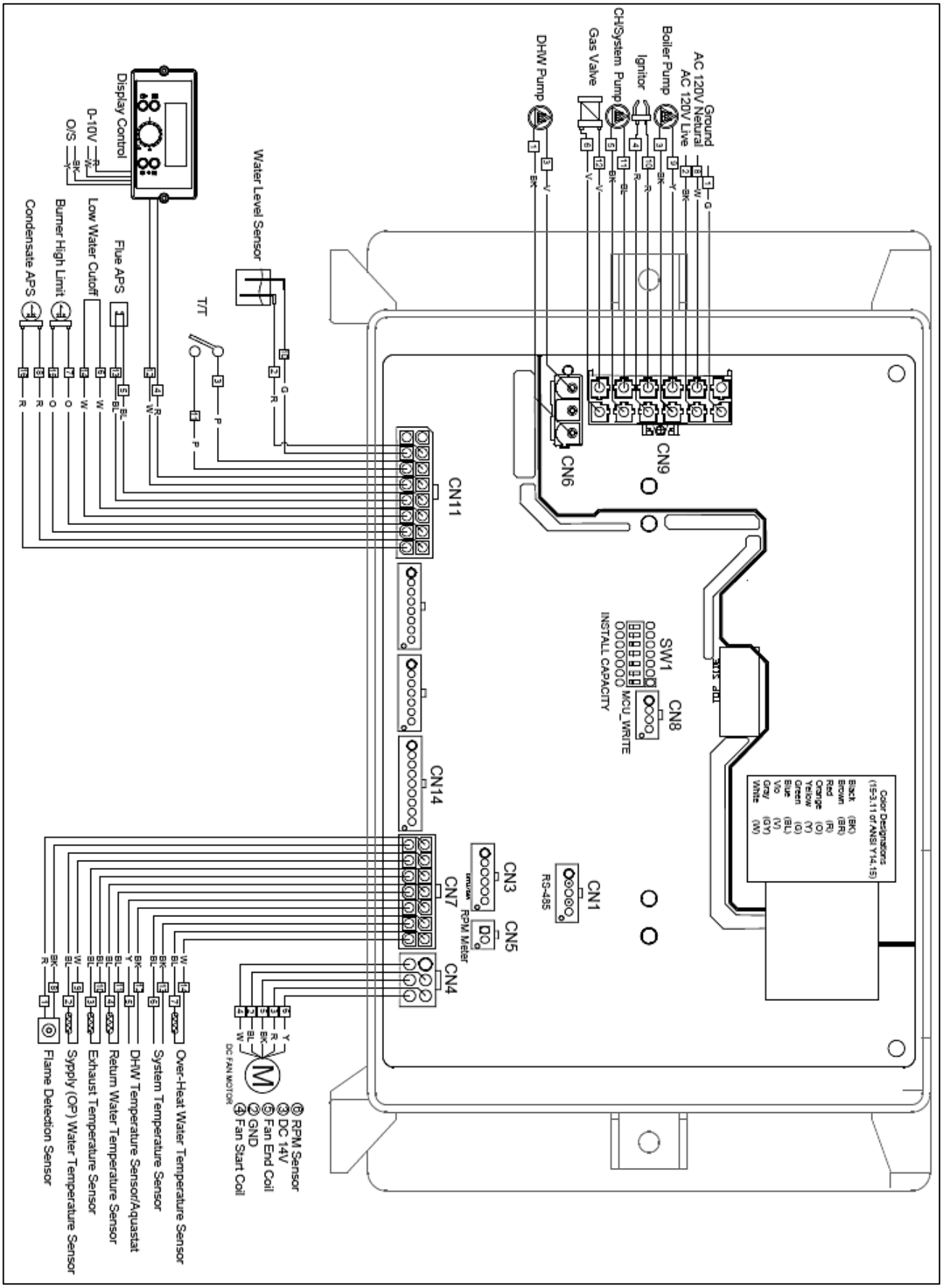


Figure 38 – Electrical Wiring Diagram

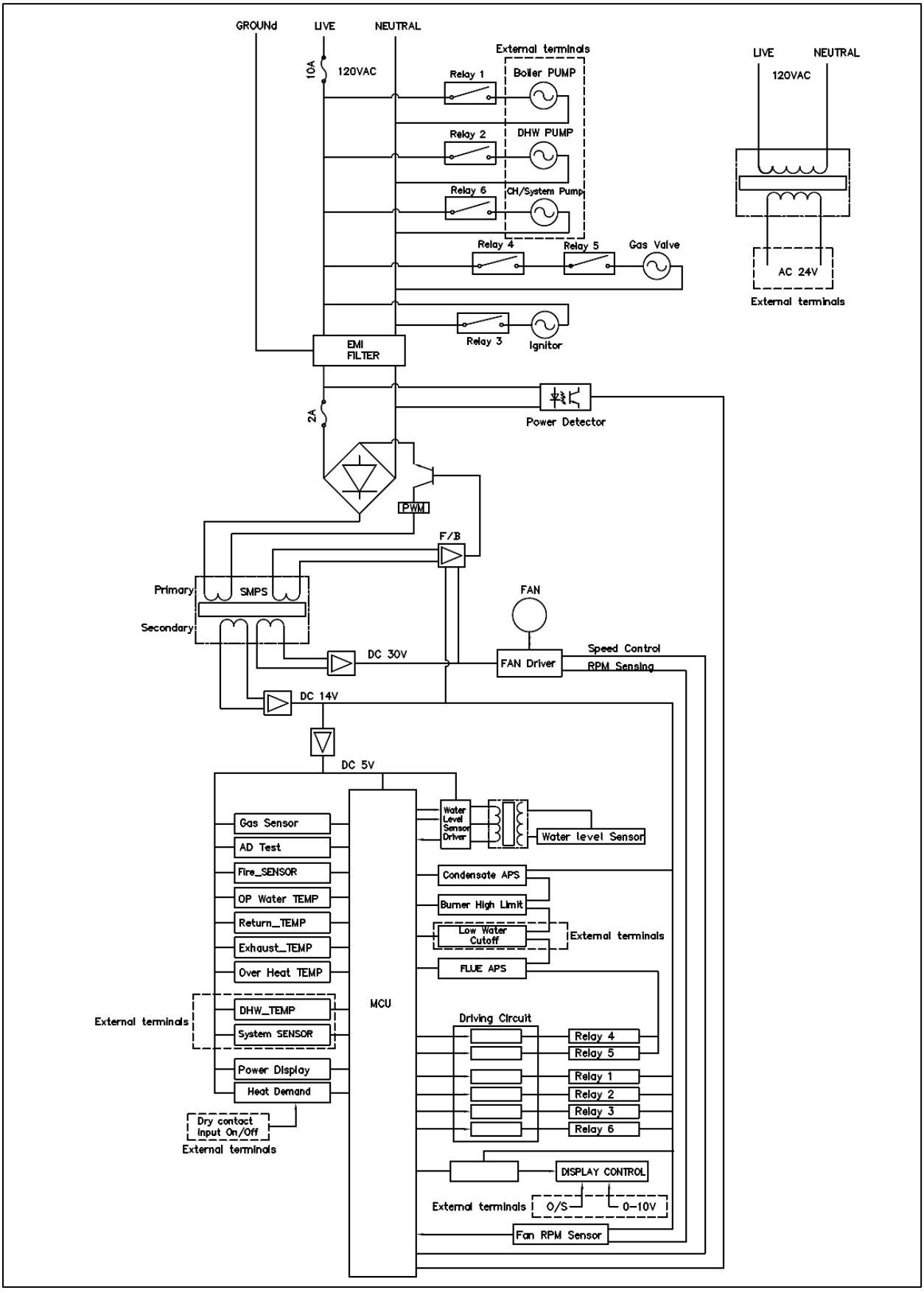


Figure 39 – Ladder Diagram

CONNECTOR			DESCRIPTION		HT SELV
NO. OF LOCATION	PIN	BOARD SILK			
CN9 65001WS-12	1	⏚	GROUND		HT (120V~) AC
	2	L	Power Supply Line		
	3	CP1	Boiler Pump Power Supply (Live)		
	4	IT	Ignitor Power Supply		
	5	L(HT)	CH / System Pump Power Supply (Live)		
	6	GV	Gas Valve Power Supply		
	7	⏚	-		
	8	N	Boiler Pump Power Supply (Neutral)		
	9-12	N	Power Supply (Neutral)		
CN6 LW6A4-03	1	CP2/3WAY	DHW Pump Power Supply (Live)		
	3		DHW Pump Power Supply (Neutral)		
CN1 SMW250-03	1	RS-485	RS485 +	Cascade Connection	SELV (5V) DC
	2		RS485 -		
	3		-		
	4		RS485 +		
	5		RS485 -		
CN4 LWD1140-06	1	FAN	NOT USED		-
	2		GND		SELV (14V) DC
	3		VDD		
	4		Fan power (start coil)		SELV (8-26VAC)
	5		Fan power (end coil)		
	6		Fan speed feedback signal		SELV (14V) DC
CN8 SMW250-04	1	MCU ISP	GND		SELV (5V) DC
	2		ISP / Reset Port		
	3		ISP TOOL0 Data Port		
	4		VCC		
CN11 LWD1140-16	1	HWL	NOT USED		SELV (12V~) AC
	9				
	2	LWL	Water Level Sensor		
	10				
	3	HD	Central Heating Demand (T/T)		SELV (5V) DC
	11				
	4	TH	Connect to the Display Control		SELV (14V) DC
	12				
	5	APS	Flue Air Pressure Switch		
	13				
	6	EL	Low Water Cutoff (External)		
	14				
	7	BL	Burner High Limit		
	15				
	8	HL	Condensate APS		
	16				

Table 20 – Boiler Wiring 1

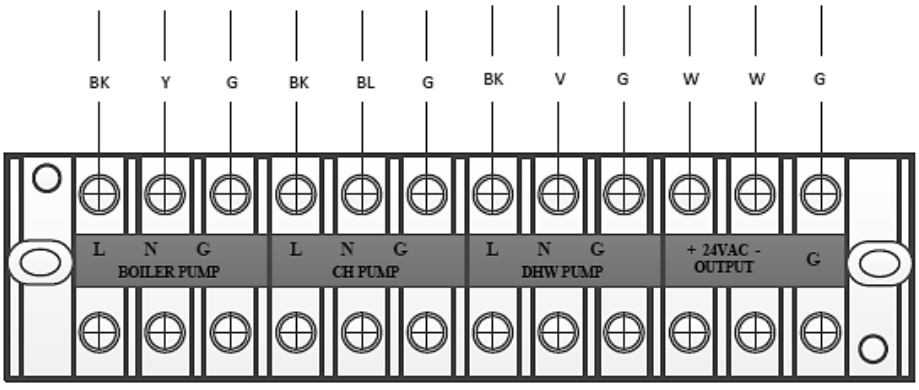


Figure 40 – Line Voltage Wiring Detail

CONNECTOR			DESCRIPTION	HT SELV
NO. OF LOCATION	PIN	BOARD SILK		
CN7 LWD1140-14	1	F.S	Flame Detect Sensor	SELV (5V)
	8			
	2	OP.S	Supply Operating Water Temperature Sensor	
	9			
	3	DH.S	Exhaust Temperature Sensor	
	10			
	4	I.S	Return Water Temperature Sensor	
	11			
	5	BG.S	External DHW Temperature Sensor / Aquastat	
	12			
	6	ST.S	External System Temperature Sensor	
	13			
	7	SP.S	Over-Heat Temperature Sensor	
	14			
CN14 SMW250-09	1-9	IWM	NOT USED	SELV (5V)
CN3 SMW250-06	1-6	FLUX1	NOT USED	
CN5 SMW250-10	1	RPM	Fan RPM Check	
	2		GND	

Table 21 – Boiler Wiring 2

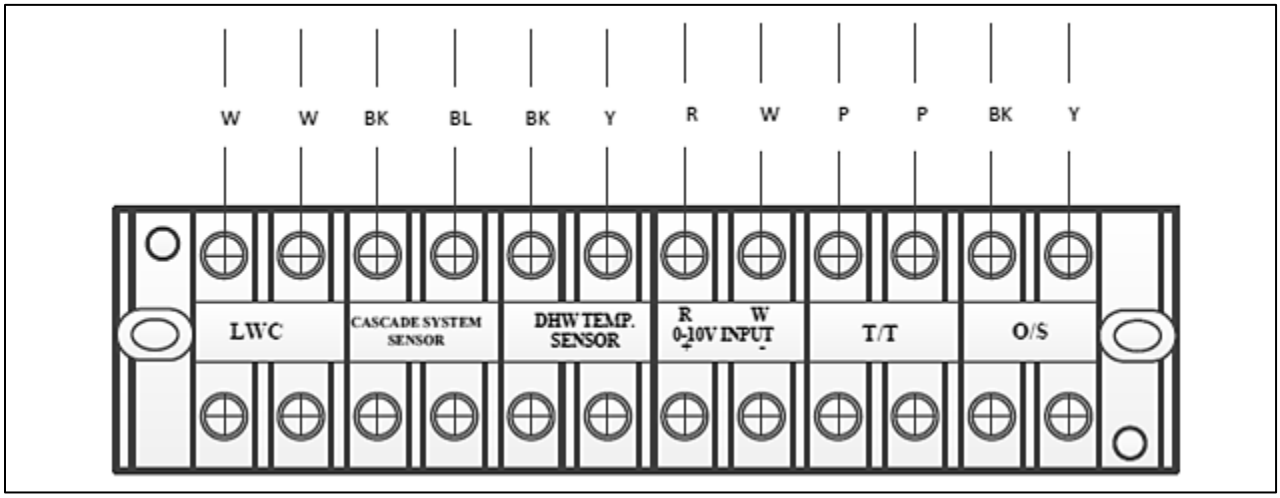


Figure 41 – Low Voltage Wiring Detail

PART 10 – OPERATING SYSTEM INSTRUCTIONS

A. CONTROL PANEL

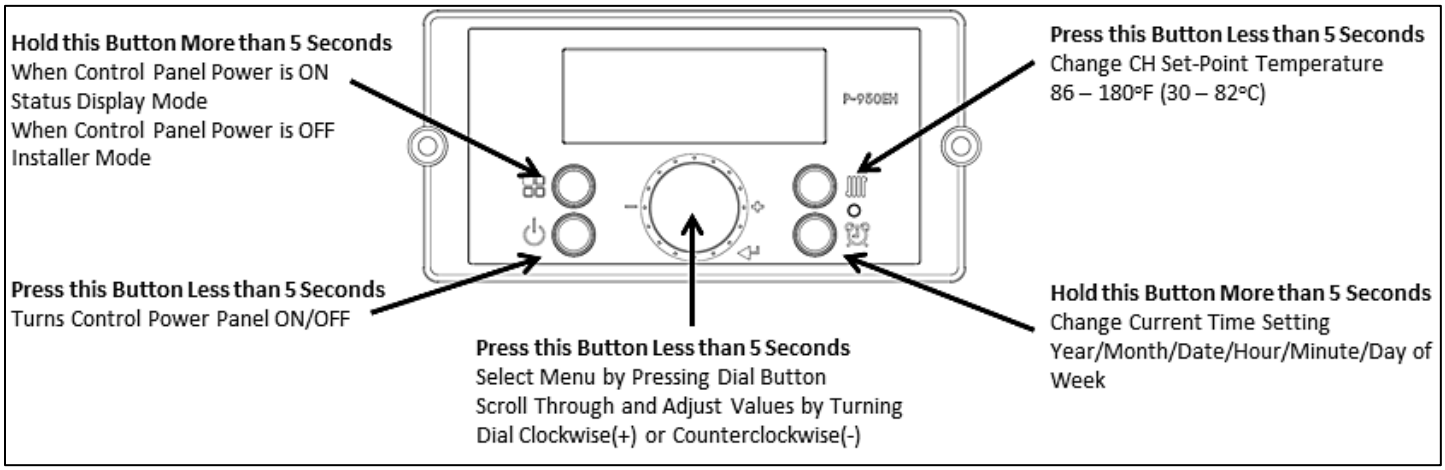


Figure 42 – Boiler Control Panel Detail

B. LCD DISPLAY DESCRIPTIONS

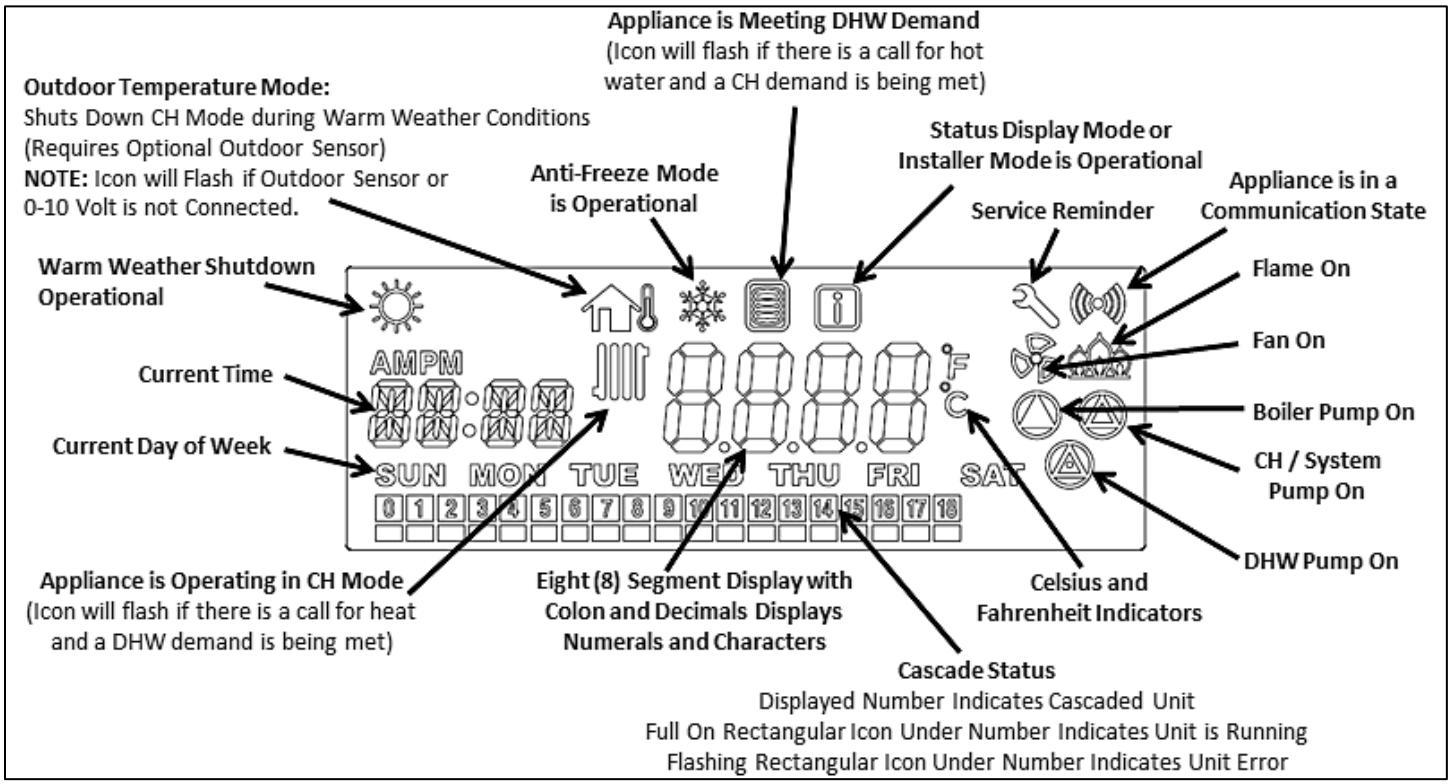


Figure 43 – LCD Display Detail

LCD also features a backlit lamp that will illuminate:

- When a user action is detected (a button is pressed)
- The display has timed out for approximately 2 minutes

C. START-UP SEQUENCE

After the boiler is powered ON, the LCD display shows a sequence of information. The icons will flash, followed by various indicators that describe the boiler controller and software versions. It will take the boiler roughly 15 seconds to cycle through the Start-Up Sequence.

NOTE: When the boiler is powered ON, the fan will operate at maximum speed for 1 minute to purge the air and any fumes from the intake and exhaust pipes.

Display Items	Time for Display	Remarks
LCD Test	1 Sec	All segments “ON”
	0.5 Sec	All segments “OFF”
Boiler Category: UFT	1 Sec	Pdn
	1 Sec	0071
Software Version for Front Panel	1 Sec	SPn
	1 Sec	00.XX
Software Version for Boiler	1 Sec	SFn
	1 Sec	00.XX
Hardware Version for Boiler	1 Sec	Hdn
	1 Sec	00XX

Table 22 – Start-Up Sequence

After start-up, the display appears as follows.

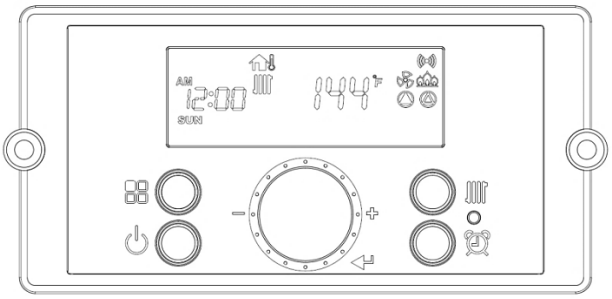


Figure 44 – Initial Display Screen Example

NOTE: The initial display screen will differ depending on a number of factors, including whether the boiler detects a call for heat or hot water.

The Control System can operate through user and service modes that have specific LCD outputs and dedicated controls, including:

- Changing the Set-Point Temperature
- Changing the Time
- Status Display Mode
- Installer Mode
- Error Mode
- Outdoor Temperature Mode

D. CHANGING THE CH SET-POINT

Press the button when the display panel is powered ON. The display will appear as follows. The set-point will flash when the CH Set-Point can be changed.

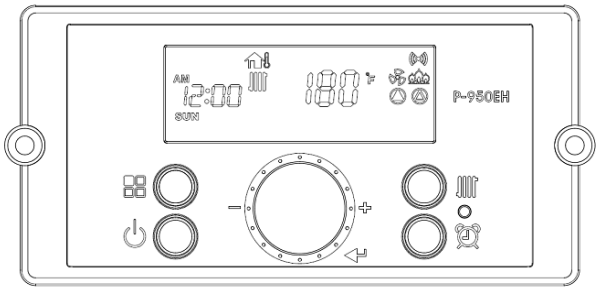


Figure 45 – CH Set-Point Screen

Factory CH Set-Point is 180°F (82°C). CH Set-Point range is 86 – 180°F (30 – 82°C).

Turn the dial counterclockwise to lower and clockwise to raise the current CH set-point. After changing the temperature, press the button to save the setting.

NOTE: The CH Set-Point cannot be changed by pressing the button if an outdoor sensor or 0-10V is connected to the boiler. When using an outdoor sensor, the boiler will automatically change the target temperature based on the outdoor reset curve. When using 0-10V, the boiler will automatically change the target temperature based on input voltage.

NOTE: If input voltage is less than 1.5V the 0-10V will be ignored.

E. CHANGING THE TIME

Press and hold the button for five seconds when the display panel is powered ON to change the time. The settings can be adjusted as follows: Year / Month / Date / Hour / Minute / Day of Week.

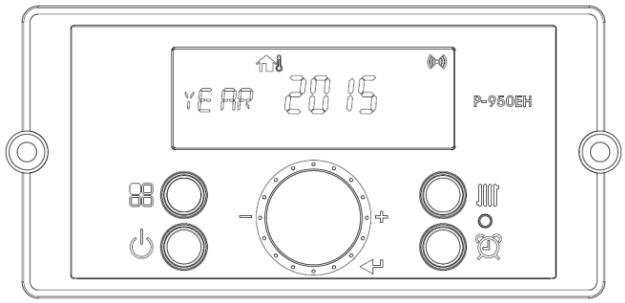


Figure 46 – Storage Mode Screen

Turn the dial counterclockwise to lower and clockwise to raise the current time setting. After changing the setting, press the button to save the setting. The next adjustable setting will appear. Press the button to return to the main screen.

F. STATUS DISPLAY MODE

Status Display Mode will activate when the button is pressed and held for five seconds when the display panel is powered ON.

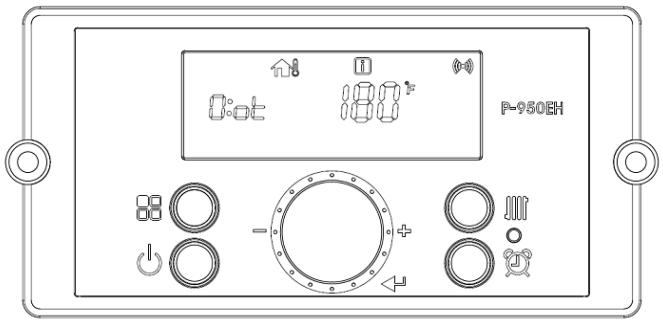


Figure 47 – Status Mode Screens

Turn the dial counterclockwise and clockwise to scroll through the displayed parameters. To view parameter details, press the button at the appropriate screen. Press the or buttons to leave the parameter.

Press the button again to return to Operation Mode.

To turn on Lock Mode, press the button at the d:Lc parameter. Turn the dial counterclockwise or clockwise to scroll On or Off. Press the button to save the selection and return to the parameters.
Press the button again to return to Operation Mode.

NOTE: The Control System will not allow the changes if Lock Mode is activated. Lock Mode will have to be turned off before making further changes.

Parameter	Detail	Description
O: ot	Outdoor Temperature (If --- is displayed, no outdoor sensor is connected)	Current Outdoor Sensor Temperature
A: In	0-10V Display (If --- is displayed, no 0-10V input is connected)	Current Voltage of 0-10V Input
b: tt	CH Target Temperature	Current CH Target Temperature
C: It	CH Return Temperature	Current CH Return Temperature

d: Fr		Fan speed (RPM)		Current Fan Speed in RPM	
E: oP		CH Supply Temperature (Operating Temperature)		Current CH Supply Temperature	
f: Eh		Exhaust Gas Temperature		Current Exhaust Gas Temperature	
H: dH		Indirect DHW Tank Temperature (If OFF is Displayed DHW Sensor is Not Connected)		Current DHW tank temperature measured by the indirect tank sensor (7250P-325) will be displayed If OFF is displayed - a mechanical aqua stat is connected and the contact is open, or no sensor is connected. If ON is displayed - a mechanical aqua stat is connected and the contact is shorted.	
I: oH		CH Overheat Temperature		Current CH Overheat Temperature	
L: rt	**1: PH**	Burner Operation Time	Supply power time	**L:rt** display on sub menu	Unit : 1,000 hour
	2: rh		Burner operation time		Unit : 1 hour
	3: rH		Burner operation time		Unit : 1,000 hour
	4: It		Ignition cycles		Cycle : 10 times displayed
	5: IH		Ignition cycles		Cycle : 10,000 times displayed
M: CC	**SELF**	Capacity of the Master (percentage)		Percentage of Master Unit Running	
	ALL	Total Cascade Capacity (percentage). This icon will only be displayed when the units are in cascade mode. **NOTE:** This index will only be shown in cascade mode.		Percentage of cascade units running. This screen shows the overall cascade power output. The range of this value of boilers communicating with the Master x 100. For example, if 8 boilers are connected and communicating, the maximum cascade power is 800%. Range: 0-100%	
	F1-F19	Capacity of individual boilers (percentage). This icon will only be displayed when the units are in cascade mode.		Percentage of each cascade units running. Ex. M, F1, F2, ….	
N: St		System Temperature (Cascade Mode) (If Sensor is Not Connected, Screen will Display 0F or 0C) **NOTE:** This index will only be shown in cascade mode.		Current System Temperature (Cascade Mode)	

Table 23 – Status Mode Display Screen Descriptions

G. INSTALLER MODE

Installer Mode will activate when the ⊞ button is pressed and held for five seconds while the display is powered OFF. If the display is powered on, press the ⏻ button to turn it off before pressing and holding the ⊞ button for five seconds.

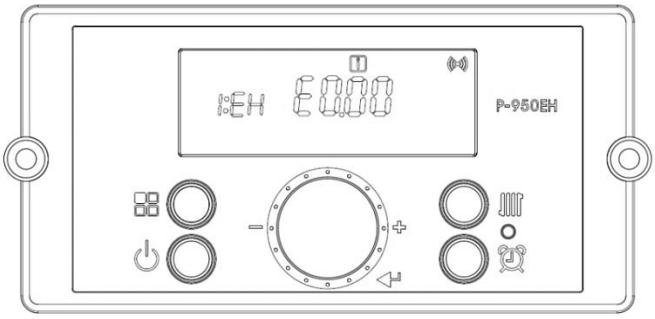


Figure 48 – Installer Mode Screens

Toggle through items that can be viewed/changed by turning the dial ◎. To view/change an item, press the ⏎ button. Some displayed items can be changed by turning the dial ◎ counterclockwise to lower and clockwise to raise the displayed value. Press the ⏎ button again to save settings.

To leave Installer Mode, press the ⊞ button again. The display will return to power off mode.

Display	Default	Detail	Description
1:EH	E0:00	Error history up to 10	Check last 10 error codes (E0 - E9)
2:cE	OFF	Delete Error history	Select “ON” to delete error code history Range: ON or OFF
3:In	OFF	System Reset (Factory Settings)	Select “ON” to reset to factory setting (Burner operation time, Ignition cycles, and Supply power time will not be reset. See Functions 14 and 15.) Range: ON or OFF

4:OH	68F	Maximum Outdoor Temperature	When used with an outdoor sensor, sets the maximum outdoor design temperature for the system design. Maximum outdoor temperature must be set 9°F above the minimum outdoor temperature. Range: (Minimum Outdoor Temperature + 9°F) to 110°F
5:OL	5F	Minimum Outdoor Temperature	Sets the minimum outdoor design temperature for the system. Minimum outdoor temperature must be set 9°F below the maximum outdoor temperature. Range: -4°F to (Maximum Outdoor Temperature - 9°F)
6:cH	180F	Maximum Supply Temperature	Sets the maximum design supply temperature based on the minimum outdoor design temperature. Maximum supply temperature must be set at least 9°F above the minimum supply temperature. Range: (Minimum Supply Temperature + 9°F) - 180°F
7:cL	86F	Minimum Supply Temperature	Sets the design supply water temperature based on the maximum outdoor design temperature. Minimum supply temperature must be set at least 9°F below the maximum supply temperature. Range: 40°F to (Maximum Supply Temperature - 9°F) Default: 86°F
8:OF	68F	Warm Weather Shutdown	When outdoor temperature sensor is used, warm weather shut down will shut down CH Mode if the programmed outdoor temperature is exceeded. Range: 50 - 110°F
9:bt	0	Boost Function	When Outdoor Temperature Mode is used, Boost Function increases the CH set point temperature by the Boost Degree temperature [10:bd]) at time intervals (Boost Interval [11:bI]). A space heating demand must be active without a DHW demand over the Boost Function set period of time (9:bt) for boost to activate. Boost continues until the boiler reaches the maximum supply temperature set point (6:cH) based on the outdoor reset curve. The boiler will return to normal operation after the thermostat is satisfied. Range: 0 - 120 min **NOTE:** "0" means boost function is OFF.
10:bd	10F	Boost Degree	Sets the temperature added to the boiler target set point based on the Outdoor Temperature reset curve. Range: 5 - 15F Default: 10F
11:bl	20 MIN	Boost Interval	Sets the interval time when the boiler will increase the temperature by the Boost Degree. Ex: Initial Boost: 10F. After 20 MIN Interval: Boost will increase CH set point temperature another 10F. After another 20 MIN Interval: Boost will increase CH set point temperature another 10F. This will continue until the boiler reaches the maximum supply temperature set point (6:cH) based on the outdoor reset curve, or until the thermostat is satisfied. Range: 0 - 120 MIN Default: 20 MIN
12:FH	00	Maximum Fan Speed	Adjusts Maximum Fan Speed Range: -30 to +30
13:FL	00	Minimum Fan Speed	Adjusts Minimum Fan Speed Range: -30 to +30
14:dr	NO	Reset burner operation time	Select YES to Initialize burner operation time Range: NO or YES
15:dI	NO	Reset ignition cycle	Select YES to Initialize ignition cycles Range: NO or YES
16:Ft	1	CH Anti-Cycling time	This function delays burner operation during CH mode Range: 0 - 20 min
17:bo	30F	Set differential temperature to turn burner "ON"	When set, the appliance will operate to heat CH water when water temperature falls below a differential setting. Example: If set point is 180°F and differential is 30°F, the appliance will turn on when CH water temperature falls below 150°F. Range: 5 - 30°F
18:cb	100	Heating capacity	Set Heating combustion rate Range: 50 - 100%
19:db	100	DHW capacity	Set DHW combustion rate Range: 50 - 100%
20:PE	1MIN	Heating Pump Post-Purge Time, T/T Satisfied	Allows the user to set the appliance pump post purge time once the thermostat is satisfied. Range: 0-5 minutes
21:dH	120F	Indirect Storage Tank Temperature Set Point	Sets Maximum Indirect storage tank Temperature Range:95 - 180°F
22:dd	7 F	Indirect Storage Tank Differential Set Point	DHW Differential Set Point Range: 5-30 F
23:Pr	1 MIN	DHW Pump Post Run Time	DHW Pump Post Run Time Range: 0-10 Min
24:DP	30 Min	DHW Priority Timer	DHW Priority Timer Range: 0 – 60 Min **NOTE:** If zero is selected DHW will always be priority.
25:ST	180F	Boiler Supply Indirect Storage Tank Temperature	Boiler Supply Indirect Tank Temperature Range: 120 – 180 F

26:FP		ON	System Freeze Protection Mode (Activates Based on Internal Supply Water Temperature)	**Freeze Protection Operation** **Stage 1** – If control detects water temperature of 46°F (8°C) and below, it turns the DHW indirect and CH pumps On for 600s and Off for 30s. This cycle repeats until the control detects water temperature of 50°F (10°C) and above. **Stage 2** – If control detects water temperature of 41°F (5°C) and below, it turns the burner on to meet a target temperature of 104°F (40°C). The burner and DHW indirect and CH pumps will run continuously during this stage until the control detects water temperature of 104°F (40°C) and above. **Stage 3 -** If control detects water temperature of 34°F (1°C) and below, Er: 85 will appear on the display. The control turns the burner on to meet a target temperature of 104°F (40°C). The burner and DHW indirect and CH pumps will run continuously during this stage until the control detects water temperature of 104°F (40°C) and above.	**Range** ON or OFF (Default: ON) NOTE: If using boiler for Snow Melt applications, turn Freeze Protection OFF.
27:cn		0	Cascade Address	Cascade Number Range: 0 (Master), 1 (follower 1), …., 19 (follower 19) Default: 0 **NOTE:** "28:cP" needs to be set on the Master boiler with total number of cascaded units before setting "27: cn" **NOTE:** The Master boiler must always be addressed 0.	
28:cP		1	Cascade Parameter	Total number of cascaded units (Set on cascade Master boiler ONLY.) **NOTE:** 28:cP will not appear on Follower boilers once it has been selected on the Master. Range: 1 – 20 (Default: 1)	
29:Eh		OFF	Common Vent	Common Vent Range: ON / OFF	
30:Cr	**Cr:at**	Auto	Automatic rotation (default)	The first unit to operate when there is a T/T call is the unit that ran the least amount of time during the prior heat calls (burner ON time).	
	Cr:Ct	48	Cascade Rotation time	Cascade Rotation time Range: 0-240 Hours	
31:CT		180F	Cascade System temperature	Cascade System temperature: Range: 95F – 180F	
32:Cd		10 F	Cascade System Temperature Differential (burner ON)	Cascade System Temperature Differential (burner ON) Range: 5-30 F	
33:HA		HA 0	High Elevation Mode	This boiler may be installed at elevations up to 10,000 feet and operate on either Natural or LP. The appliance will de-rate by 4% for each 1000 feet above sea level. Select the appropriate installation location as described below. Selects Installation Location for Proper Boiler Operation at Elevation: 0-2 for installation locations from sea level to 2000 feet 2-5 for locations from 2000 to 5000 feet 5-8 for locations from 5000 to 8000 feet, 8-10 for locations from 8000 to 10000 feet Default: 0 – 2 **NOTE:** Use a combustion analyzer to ensure CO and CO2 are within the ranges shown in this manual. Adjust the offset screw in the clockwise (positive) or counterclockwise (negative) directions (approximately 1/8 turn) if the measured CO2 value on LOW FIRE is out of range.	
34:AP	**AP:cP**	5	CH System Pump and DHW Indirect Pump Test Mode	This function sets the time to run Boiler pump, CH System pump or DHW Indirect pump to purge air from the system. Range: 1 – 30 minutes	
	cP1:Off or cP1:On	OFF	Boiler and CH System Pumps Test Mode	Turn this function on to activate Boiler pump and CH System pump. Only works in installation mode. Turns off when in normal mode.	
	cP2:Off or cP2:On	OFF	DHW Indirect Pump Test Mode	Turn this function on to activate DHW Indirect pump. Only works in installation mode. Turns off when in normal mode.	
35:SS	**SS:Sd**	OFF	OFF	Allows the user to set the date of next service reminder XX / XX / XXXX (MONTH / DAY / YEAR) A wrench will be displayed on the display panel when the service is due.	
		YEAR	Allows the user to set the year of next service reminder		
		MON			
		DATE			
	SS:br	00	Allows the user to set the service reminder based on BURNER RUN HOURS	Allows the user to set the service reminder based on BURNER RUN HOURS A clock will be displayed on the display panel when the service is due. Range: 00 indexing to 9,999 hours **NOTE:** Two digits will appear initially. As you scroll to the right more digits will appear.	

36:UC	**FAH(F)** / **CEL(C)**	FAH(F)	Allows the user to change the unit	Allows the user to change the unit Range: F or C
37:CM		OFF	CH Step Modulation	Allows the user to turn ON the 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. Default: OFF (Selection: OFF or ON).
38:dM		OFF	DHW Step Modulation	
39:SA		AquA	Aquastat	An aquastat or indirect sensor can be used when using an indirect water heater. Range: AquA or SEnS. Default: AquA **NOTE**: If an aquastat is used and SEnS is selected, the boiler will not operate and Er.32 will display. If a sensor is used and AquA is selected, the boiler will not operate. No error will display.
		SEnS	Sensor	
40:BP		OFF	Boiler Pump Operation Mode	When turned "ON" the Boiler pump can operate while there is a DHW demand. **NOTE:** This can be useful when the boiler is used to retrofit an older unit and DHW piping is connected to the system loop.

Table 24 – Installer Mode Descriptions

H. ERROR MODE

The following screen will display when the boiler encounters an error. The boiler control is able to record information about the boiler's condition at the time of the ten previous faults or errors. This information is available to view in the Installer Mode under the History screen.

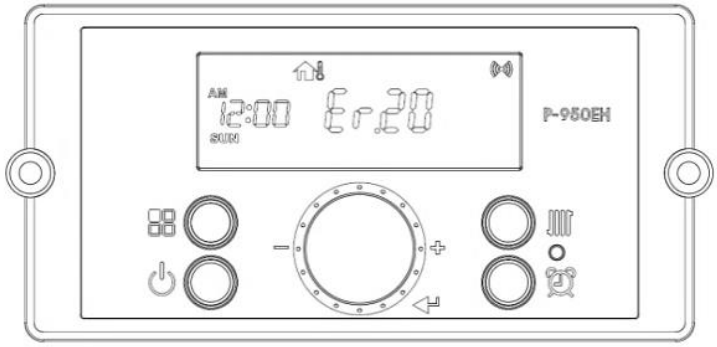


Figure 49 – Error Mode Screen

Error Code	Description	Possible Remedies
Er:10	Flame has Extinguished 5 (Five) Times	Press the Power button to clear the Error Code. If Error happens again: 1. Monitor the gas pressure to the boiler while in operation. Ensure pressure is between 3.5 and 14" WC. 2. Check gas valve wire. Ensure connection is secure. 3. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 4. Check vent terminations. Ensure there are no blockages. 5. Assure that the flame is stable when lit. 6. If the problem persists, replace the main control.
Er:11	Ignition has Failed 5 (Five) Times	Press the Power button to clear the Error Code. If Error happens again: 1. Monitor the gas pressure to the boiler while in operation. Ensure pressure is between 3.5 and 14" WC. Ensure there is no air in the gas supply line by bleeding the line. 2. Check gas valve wire. Ensure connection is secure. Ensure the gas valve is opening during ignition trials (use a carbon steel screw driver to check magnet on the gas valve coil). 3. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 4. Check igniter transformer for proper connection. 5. Clean the spark igniter with steel wool to remove oxides. Ensure proper separation (3-4 mm). 6. Replace the spark igniter if damaged. 7. Assure that the flame is stable when lit. 8. If the problem persists, replace the main control.
Er:16	Operating Temperature Sensor detects Water Temperature Greater than 203°F (95°C)	Press the Power button to clear the Error Code. If Error happens again: 1. Check if dip switch High Fire setting is ON. Switches 6 and 7 should be OFF for normal operation. 2. Check if CH inlet pipe is blocked. Ensure there is enough water flowing to the boiler. 3. Check Operating Temperature sensor at CH heat exchanger outlet. If resistance is zero, replace the sensor. 4. Ensure the pumps are properly connected and circulating water. 5. If the problem persists, replace the main control. **NOTE:** During the error state, the pump will operate to cool the boiler until temperature is below 192°F.

Er:20	Condensate – Closed is Normal, Open is Fault (Condensate Drain Trap)	Press the Power button to clear the Error Code. 1. Check Condensate and main controller connections. Ensure all are secure. 2. Check Condensate sensor resistance. If resistance is not zero, replace the switch. 3. Check Condensate hose. Ensure it is connected and in good condition. 4. Check condensate line and termination for blockages. 5. Check exhaust vent for blockages. 6. If the problem persists, replace the main control.
Er:28	Overheat Sensor Open or Short	This Error Code will go away when CH temperature decreases. If Error happens again: 1. Check overheat temperature sensor. Ensure connections are secure. 2. Check overheat sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.
Er:29	APS Open	1. Check APS and connections. 2. If APS is open, replace the switch. 3. If APS is closed and connections are secure, check switch resistance. If resistance is not zero, replace the switch. 4. Check condensate line and termination for blockages. 5. Check exhaust vent for blockages. 6. Press the Power button to clear the Error Code and restart boiler. 7. If the problem persists, replace the main control.
Er:30	System Sensor Short	**NOTE:** This error will only appear if the boiler is used in a cascaded system. This Error Code will go away when system sensor is repaired or replaced. 1. Check system temperature sensor. Ensure connections are secure. 2. Check system sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control. **NOTE:** During the error state the units will continue to operate. Boiler setpoint will be the same as the system sensor setpoint until the issue is remedied. During normal operation boiler setpoint is defaulted to 20°F higher than the system setpoint to a maximum of 180°F setting.
Er:31	Return Temperature Sensor Open or Short	This Error Code will go away when operating temperature decreases. If Error happens again: 1. Check return temperature sensor. Ensure connections are secure. 2. Check return sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.
Er:32	DHW Sensor Short	**NOTE:** This error will only appear if an aquastat is installed and SEnS is selected in Installer Mode 39, or a sensor is used and it is shorted. This Error Code will go away if an aquastat is installed, AquA is selected in Installer Mode 39, and the boiler is powered OFF and ON, or the DHW sensor is repaired or replaced. 1. Check DHW sensor. If an aquastat, ensure AquA is selected in Installer Mode 39. If a sensor, ensure connections are secure. 2. Check DHW sensor resistance. If resistance is zero or does not match that in Table 32, replace the sensor. 3. After completing steps 1 and 2, power the boiler OFF. Then turn it back ON. 4. If the problem persists, replace the main control.
Er:33	CH Temperature Sensor Open or Short	This Error Code will go away when operating temperature decreases. If Error happens again: 1. Check CH temperature sensor. Ensure connections are secure. 2. Check CH sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.
Er:35	Exhaust Sensor Open or Short	This Error Code will go away when exhaust temperature decreases. If Error happens again: 1. Check exhaust temperature sensor. Ensure connections are secure. 2. Check sensor resistance. If resistance is zero, replace the sensor. 3. Check exhaust vent for blockage. 4. If the problem persists, replace the main control.
Er:37	Abnormal Supply Frequency	Supply frequency is too high to operate. This Error Code will go away when supply frequency returns to normal operating range. If Error happens again: 1. Ensure appliance is properly wired to a power source meeting the requirements on the rating plate. 2. If problem persists, replace the main control.
Er:38	Error Appears When Control Stores Data, but Data is not Saved	Press the Power button to clear the Error Code. Replace the main control.
Er:40	Gas Leakage is Detected for Greater than 5 seconds, or three times within 10 minutes	**IMPORTANT:** If you smell gas, STOP! Follow the instructions on page 2, this manual, and call a qualified service technician or the fuel gas utility. Press the Power button to clear the Error Code. If Error happens again: 1. Check the boiler cover. Ensure it is secure. 2. Check gas connections for leakage with a soapy solution. Fix any leaks. 3. Check condition of the burner assembly. 4. If the problem persists, replace the main control.

Er:41	Fan Speed too High with Flame On	The Error Code will go away unless it occurs five (5) times in ten (10) minutes. Press the Power button to clear the Error Code. If Error happens again: 1. Check the vent connections for blockages. 2. Check the burner assembly. 3. Check fan operation. If fan appears to be operating normally but RPMs are too low or too high, replace the fan. 4. If the problem persists, replace the main control.
Er:42	Low Water Cutoff (LWC) Circuit is Open	Press the Power button to clear the Error Code. If Error happens again: 1. Ensure that the LWC jumper is installed if low water cut off is not in use. 2. Ensure that the LWC wires are properly installed (if in use). 3. Ensure that the LWC ground wire is properly grounded. 4. If the problem persists, replace the main control.
Er:43	Burner Overheat Switch Open	Press the Power button to clear the Error Code. If Error happens again: 1. Check burner overheat switch connections. Ensure connections are secure. 2. Check switch resistance. If resistance is not zero, replace the switch. 3. If the problem persists, replace the main control. **NOTE:** During the error state, the fan will operate to cool the burner until the switch closes.
Er:61	Fan Speed Feedback Signal Abnormal	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check the connections to the fan. Ensure all are secure. 2. If the fan does not rotate during the ignition sequence, check for AC8V~26.5V power at the fan connection. If AC8V~26.5V power is present at the control, replace the fan. If the blower does not have AC8V~26.5V power, check power at the control. If AC8V~26.5V power is not present at the control, replace the control. 3. If the problem persists, replace the main control.
Er:70	Register, Ram, Rom, I/O Port, AD Abnormal, Important EPROM Data or Safe Data Abnormal	This Error Code will go away when the condition is remedied. If Error happens again: 1. Turn power OFF and ON at the main power switch internal to the boiler. 2. If the problem persists, replace the main control.
Er:72	Flame Signal Detected before Ignition	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check the boiler cover. Ensure it is secure. Flame detection sensor can detect an external light source. 2. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 3. If the problem persists, replace the main control.
Er:76	Poor Communication	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check connections from main control to display panel (error occurs if there is no communication for 10 minutes). 2. If the problem persists, replace the display and/or the main control.
Er:78	Cascade Communication Error	**NOTE:** This error will only appear in a cascaded system. 1. Turn power OFF and ON at the boiler display panel. 2. If error reappears, ensure all cascaded boilers are powered ON. 3. If error reappears, check Installer Mode parameter 28 at the Master boiler. Ensure the number of cascaded units chosen in this parameter matches the number of cascaded units in the system. 4. If error reappears, check Installer Mode parameter 27 at all cascaded boilers. Ensure the address number matches that of the connected boiler (00 for Master, 01 for Follower 1, etc.) and that no numbers are skipped or repeated. 5. Ensure every unit in the cascade system is connected properly. Inspect the cascade cables and ensure all are connected without damage or defect. Repair or replace any damaged cables. 6. If the problem persists, replace the main control.
Er:80	Low Water Level Sensor (Low Water Level Detected Four (4) Consecutive times)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Ensure all valves are open to the boiler and there are no leaks. 2. Ensure all air has been purged from the system. 3. Check wiring connections to low water level sensor. Ensure all are secure. 4. Check low water level sensor resistance. If resistance is zero, replace the sensor. 5. If the problem persists, replace the main control.
Er:81	Low Water Level Circuit	This Error Code will go away when the condition is remedied. If Error happens again: 1. Ensure the system is filled with water. Ensure all valves are open to the boiler and there are no leaks. 2. Check wiring connections to low water level sensor. Ensure all are secure. 3. Check low water level sensor resistance. If resistance is zero, replace the sensor. 4. If the problem persists, replace the main control.

Er:85	Freeze Protection (Boiler has detected water temperature below 34°F (1°C)	This Error Code will go away when the freezing condition is remedied. If Error happens again: 1. Ensure boiler is located in a mechanical room protected from freezing conditions. 2. Ensure all valves are open to the boiler, there are no leaks. 2. Check wiring connections to low water level sensor. Ensure all are secure. 3. Check low water level sensor resistance. If resistance is zero, replace the sensor. 4. If the problem persists, replace the main control.
Er:94	Exhaust Sensor detects Vent Temperature is Greater than 190°F (88°C)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check if dip switch High Fire setting is ON. Switches 6 and 7 should be OFF for normal operation. 2. Check exhaust temperature sensor. Ensure connections are secure. 3. Check sensor resistance. If resistance is zero, replace the sensor. 4. Check exhaust vent for blockage. 5. If the problem persists, replace the control. 6. If the problem persists, replace the heat exchanger.

Table 25 – Error Codes with Linked Components, Effects, and Actions

DIAGNOSTICS AND SUGGESTED CORRECTIVE ACTIONS

The table below includes diagnostic information and possible corrective actions.

Display	Condition	Diagnostic	Possible Corrective Actions
Nothing appears on the display control panel but the blower runs at full speed	Control is not receiving power	Check wiring for short circuit or incorrect wiring	Correct wiring per wiring diagram including connection of transformer to the control
		Check transformer connection to the control per wiring diagram. Check for 12V output of transformer	Replace transformer if it is receiving 120V, but not outputting 12 VAC
Nothing appears on the display control panel and no other boiler components are operating	Control is not receiving 120V power	Ensure service switch and/or circuit breaker to boiler is turned ON	Turn on service switch or circuit breaker to power boiler
		Is there 120V at the service switch	Troubleshoot and correct the power supply to the manual switch
		Is the ON/OFF switch inside the boiler cabinet is turned on	Turn ON the manual power switch inside the boiler cabinet
		Check for 120V at the line voltage terminal block located inside the boiler cabinet	Correct wiring inside the boiler cabinet using the wiring diagram in the installation manual
		Inspect the fuse. Replace as necessary	Replace the fuse with the proper part found in the replacement part section of this manual. If fuse blows again, recheck the wiring per diagram
Nothing appears on the display control panel, but the boiler is operating	Occurs when communications is lost from the control to the display	Check for loose connections and proper pin alignment / engagement on the control's plug	Check for continuity on the wire harness from the display to the control. See repair parts section for proper replacement part.
		Cycle power off and on using boiler power switch and check for operation	Replace with new display module. See repair parts section for proper replacement part.
Display repeatedly goes through initialization sequence	Occurs when control does not receive signal from fan	Cycle power off and on using appliance power switch and check for operation	Replace fan.

Table 26 –Diagnostics and Suggested Corrective Actions

I. SETTING UP A CASCADE SYSTEM

When setting up a cascade system, each individual boiler control must be programmed for cascade operation.

Program the Master and Follower Boilers:

To program the cascade system, first enter the Installer Mode. Scroll down to and select the following parameters on each boiler in the system:

1. **28:cP** – Set the number of units in the cascade loop [range from 1-20].
2. **27:cn** – Next, set the cascade address (Master should always be addressed 0) [range from 0-19]. 27:cn cannot be changed until 28:cP is set.
   NOTE: The above parameters should be set on every unit in the cascade loop. To remove a follower from the cascade system, the Master display panel power needs to be turned off, or the cascade cable needs to be disconnected from the unit that is being removed from the cascade system.

Program the Master Boiler:

To finish programming the cascade system, enter the Installer Mode on the Master Boiler ONLY. Scroll down to and select the following parameters:

1. **30:Cr** – **MASTER ONLY** - Set cascade rotation mode to Automatic rotation or Timed rotation.
2. **31:Ct** – **MASTER ONLY** - Set system target temperature controlled by the system sensor (Range: 95-180°F, Default: 180°F).
   NOTE: To ensure proper operation, the boiler set point is defaulted at 20°F higher than the system set point to a maximum of 180°F
   NOTE: The Master boiler will display Er: 30 if the boilers are set on Cascade mode and a system sensor is not connected. Boiler setpoint will be the same as the system sensor setpoint until the issue is remedied.

See Installer Mode for details.

CAUTION
When installing a cascaded system, it is important that the boilers are the same model.
When selecting more than one boiler for DHW priority in a cascade loop, an aquastat must be used, and connected in parallel to each boiler used for DHW priority.
Failure to follow these instructions will result in improper system operation, wasted time, money, and possible property damage and personal injury. Such damages ARE NOT covered by product warranty.

J. OUTDOOR TEMPERATURE MODE (OPTIONAL)

NOTE: If the system requires a fixed operating temperature, the outdoor sensor is not required and should not be installed.

There is no connection required if an outdoor sensor is not used in the installation.

1. 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.

2. 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.

NOTE: For correct mounting procedures, follow instructions provided with the sensor.

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.

NOTE: Outdoor Temperature Mode Icon on the display will flash if an Outdoor Sensor or 0-10 Volt is not connected to the boiler.

See Figure 50 to set your Outdoor Reset Curve.

To check the CH Target Temperature while using Outdoor Temperature Mode, press the button while the boiler is operational and the display panel is powered on.

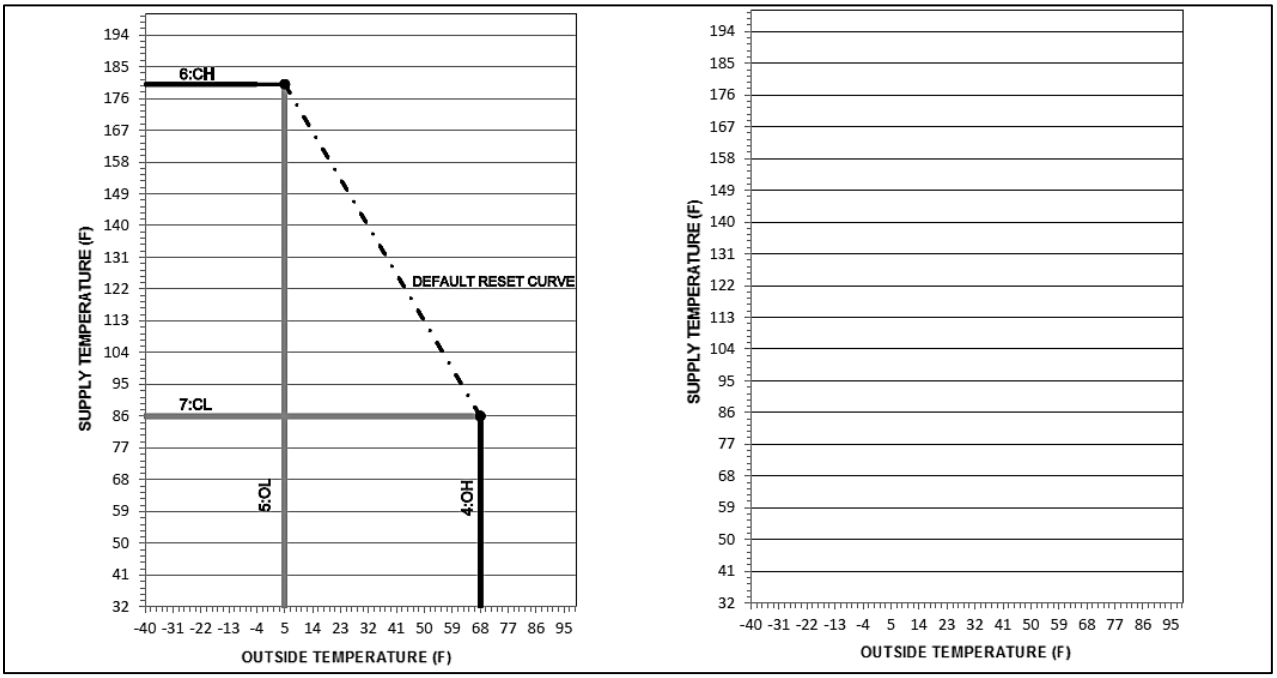


Figure 50 – Outdoor Reset Curve – See Installer Mode for Curve Setting Descriptions

K. 0-10 VOLT INPUT

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 the 0-10V input is wired to the boiler terminal strip, a building control system can be used to control the set point temperature 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 set point temperature.

2. Connect a building management system or other auxiliary control signal to the terminals marked for this purpose on the boiler terminal block (shown in Piping Diagrams, this manual). Caution should be used to ensure that the 0-10 VOLT + connection does not become connected to ground.

NOTE: Ensure that the polarity of the connections from the external modulating boiler controller to the boiler is correct. Reversed polarity could lead to erratic and/or no response from the boiler controller.

NOTE: Outdoor Temperature Mode Icon on the display will flash if an Outdoor Sensor or 0-10 Volt is not connected to the boiler.

0-10 V INPUT TABLE:

When outside voltage is applied to the connector (2) in the wiring diagram,

1. The Outdoor temperature sensor does not work.
2. Symbol  is displayed.
3. The heating temperature is automatically set according with the external voltage input.

NOTE: 0-10V is prioritized over T/T. If input voltage is less than 1.5V then T/T will operate.

The range of input voltage is approximately 1.5[V] ~ 10[V] and the heating temperature settings according to this range are as follows.

Input voltage[V]	Heat temperature [℃]	Heat temperature [℉]
1.5	30.0	86
2.0	32.7	91
2.5	36.1	97
3.0	38.8	102
	…	
9.0	75.0	167
9.5	77.7	172
10	82.2	180

Table 27 – 0-10V Input Voltages and Associated Temperatures

CAUTION
Voltage exceeding 15V may damage internal parts. Such damages are not covered by product warranty.

L. STEP MODULATION

When the Step Modulation on/off parameter is active, step modulation limits the boiler firing rate when a heating cycle starts. There are six (6) limiting steps used to limit temperature overshoot and short cycles. See Figure 51. This feature can be turned on or off depending on the installation. This parameter can be changed by the installer by accessing parameter 37:CM or 38:dM. The control range of this parameter is OFF or ON. The default value is OFF. The percentage of each step can be decreased as low as 50% by decreasing the overall capacity of the boiler in the Installer Menu changing parameters 18:cb or 19:db.

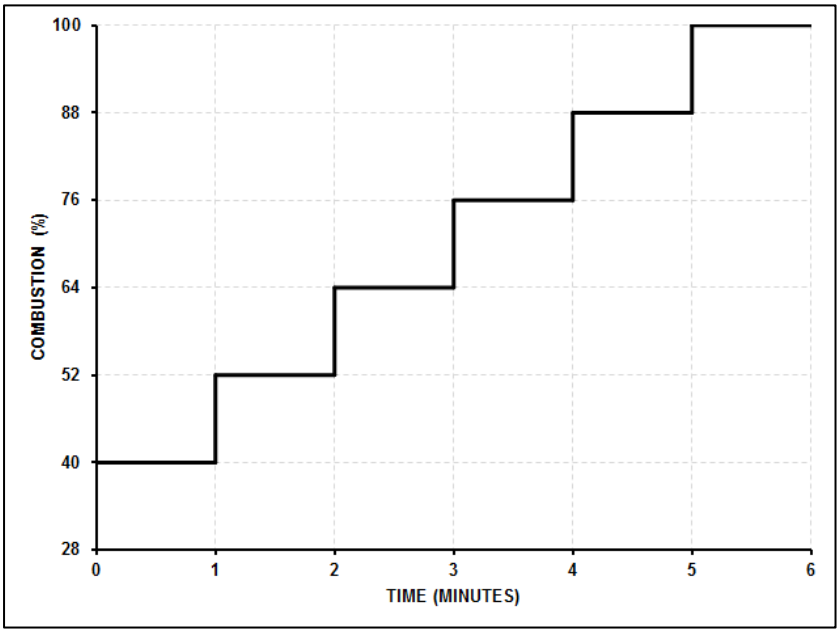


Figure 51 – Step Modulation

M. ERROR TREE ANALYSIS

1. FLAME DETECTION

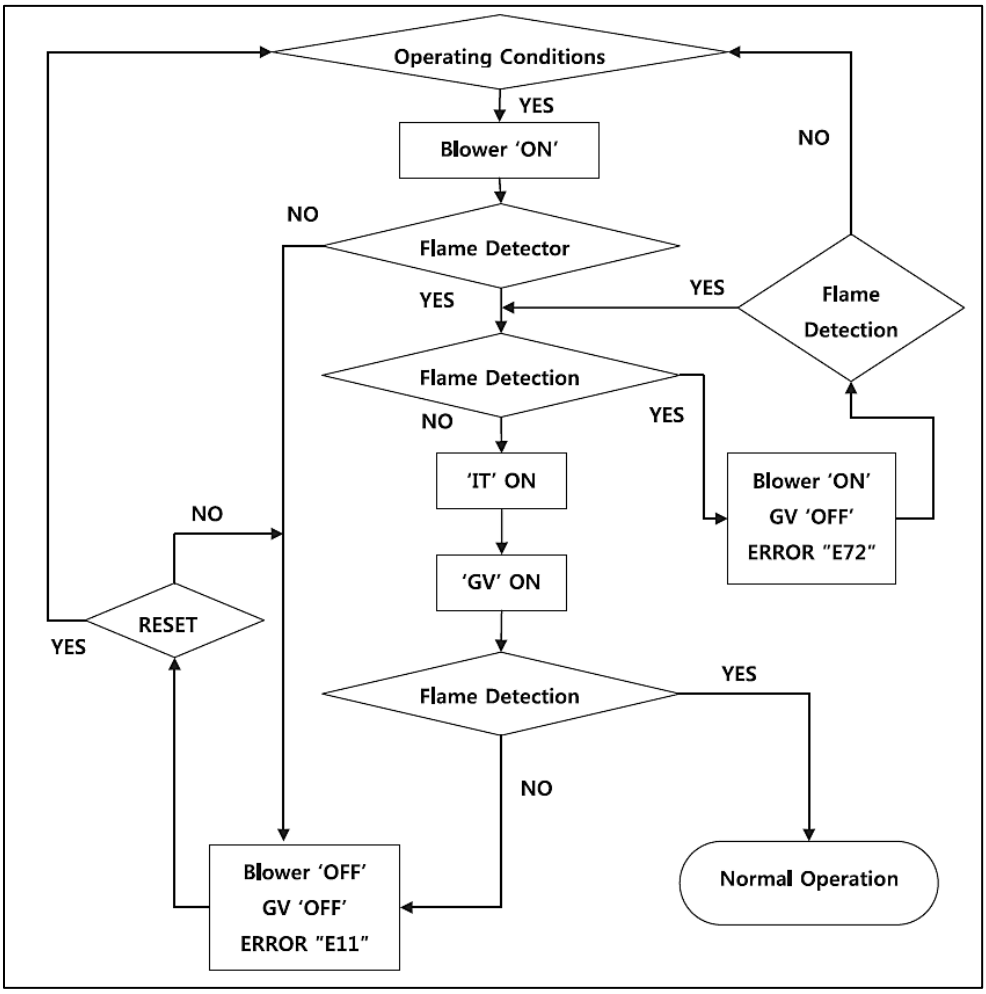


Figure 52 – Flame Detection Error Analysis Tree

2. GAS DETECTION

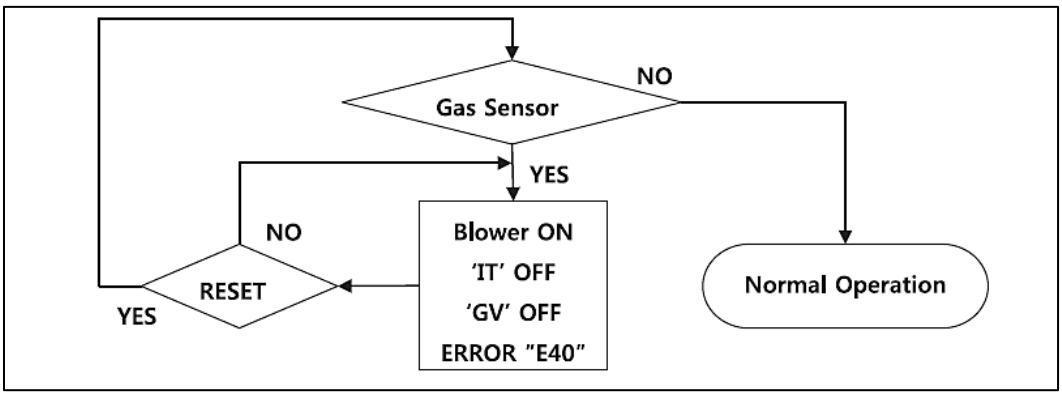


Figure 53 – Gas Detection Error Analysis Tree

3. APS / BURNER OVERHEAT LIMIT / CONDENSATE BLOCK SWITCH

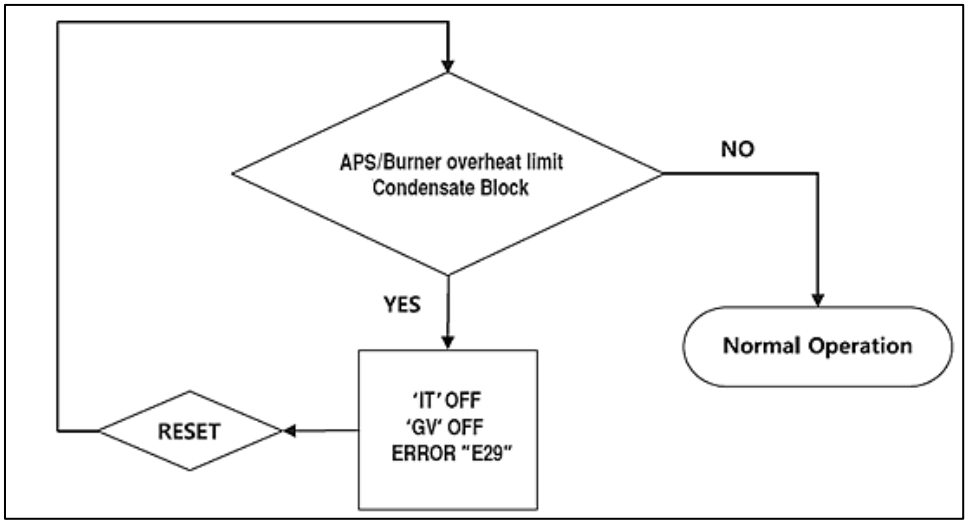


Figure 54 – APS / Burner Overheat Limit / Condensate Block Switch Error Analysis Tree

4. STORAGE / OP / CH OVERHEAT / EXHAUST OVERHEAT SENSORS

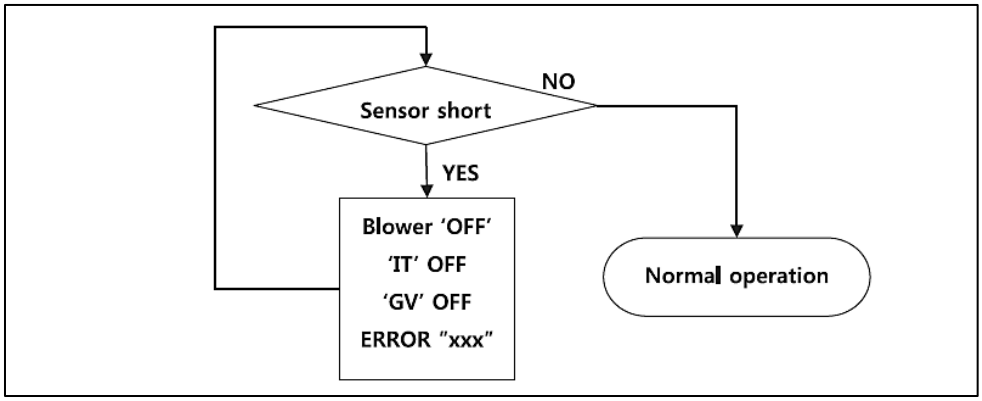


Figure 55 – DHW / OP / CH Overheat / Exhaust Overheat Sensors Error Analysis Tree

PART 11 – START-UP PREPARATION

⚠ WARNING
Thoroughly clean and flush any system that has used glycol before installing the boiler.
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.

Clean system to remove sediment*

1. You must thoroughly flush the system (without the 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. Check return Y strainer. Remove and clean sediment and debris if necessary.

4. 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 this manual.

NOTE: BOILER FAILURE DUE TO IMPROPER WATER CHEMISTRY IS NOT COVERED BY WARRANTY.

A. BOILER WATER CHEMISTRY

CAUTION

Chemical imbalance of the water supply may affect efficiency and cause severe damage to the appliance and associated equipment. 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°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.

The water must be potable, 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. Potable water is defined as drinkable water supplied from utility or well water in compliance with EPA secondary maximum contaminant levels (40 CFR Part 143.3) as shown in the table below. If the water contains contaminants higher than outlined by the EPA, water treatment is recommended and additional, more frequent maintenance may be required.

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

Contaminant	Maximum Allowable Level	Contaminant	Maximum Allowable Level
Total Hardness (Residential Use - Below 140°F water temperature)	200 mg/l (12 grains/gallon)	Manganese	0.05 mg/l or PPM
Total Hardness (Commercial Use - 140°F and above water temperature)	120 mg/l (7 grains/gallon)	pH	6.5-8.5
Aluminum	0.05 to 0.2 mg/l or PPM	Sulfate	205 mg/l or PPM
Chloride	100 mg/l or PPM	Total Dissolved Solids (TDS)	500 mg/l or PPM
Copper	1 mg/l or PPM	Zinc	5 mg/l or PPM
Iron	0.3 mg/l or PPM	Dissolved Carbon Dioxide (CO2)	15 mg/l or PPM

Table 28 – Water Quality Requirements

B. GLYCOL ANTIFREEZE SOLUTIONS

⚠ WARNING

Use only inhibited propylene 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%.

- Glycol in hydronic applications should include 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.
- The glycol solution should be tested at least once a year or as recommended by the glycol manufacturer.
- 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 expands 3% over the same temperature rise. Allowances must be made in system design for expansion.
- A 30% mixture of glycol will result in a BTU output loss of 15% with a 5% increase in head against the system circulator.
- 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 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.

C. 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 BOILERS ONLY – Propane suppliers mix an odorant with the gas 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.

⚠ WARNING

FOR YOUR OWN SAFETY READ BEFORE OPERATING

1. This boiler does not have 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.

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 gas shutoff valve (located outside of 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.

⚠ WARNING

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.

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.

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 CH residential system is 12 psi.
   b. Pressure will rise when boiler is turned on and system water temperature increases. Operating pressure of the CH system should never exceed 25 psi, and 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.

⚠ WARNING

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, causing heat exchanger failure and possibly resulting in property damage, severe personal injury, or death.

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 chlorine concentrations are acceptable by sample testing.

⚠ CAUTION

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

E. PURGE AIR FROM SYSTEM

CAUTION

IMPORTANT! While commissioning the system, the air vent on top of the boiler must remain fully open to allow the boiler to properly fill. Failure to keep the air vent open could lead to improper boiler and system operation.

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 terminal block. Apply power to the boiler. After the control goes through the start-up sequence, the display will turn off.
i. Press and hold the button for five seconds. Then scroll to 34:AP by turning the dial. Press the button. AP:cP will show on the display. Press the button to change the test time. The default is five minutes. Turn the dial counterclockwise to lower or clockwise to raise the displayed value. Press the button again to save any changes.
j. Then use the dial to scroll to cP1:off. Press the button to turn on test mode. Turn the dial counterclockwise to lower or clockwise to select on. Press the button again to start test mode.
k. The boiler and CH system pumps will come on. Run pumps 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. Test mode will stop automatically after the set time (default is five minutes), or press the button to leave it manually.
m. Then use the dial to scroll to cP2:off. Press the button to turn on test mode. Turn the dial counterclockwise to lower or clockwise to select on. Press the button again to start test mode.
n. The DHW indirect pump will come on. Run pump 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. Test mode will stop automatically after the set time (default is five minutes), or press the button to leave it manually.
o. After the system has operated for some time, eliminate any residual air by using the manual air vents located throughout the system.
p. 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.
q. Refill to correct pressure.

F. 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.

G. CONDENSATE REMOVAL

1. This is a high efficiency condensing boiler. Therefore, the boiler has a condensate drain. Condensate fluid is nothing more than water derived from combustion products, similar to that produced by an automobile when it is initially started.

Condensate 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, may be purchased from HTP (7450P-212).

2. It is very important that the minimum ¾" condensate line is sloped downward away from the boiler to a suitable inside drain. If the condensate outlet on the boiler 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 condensate line to assure proper drainage.

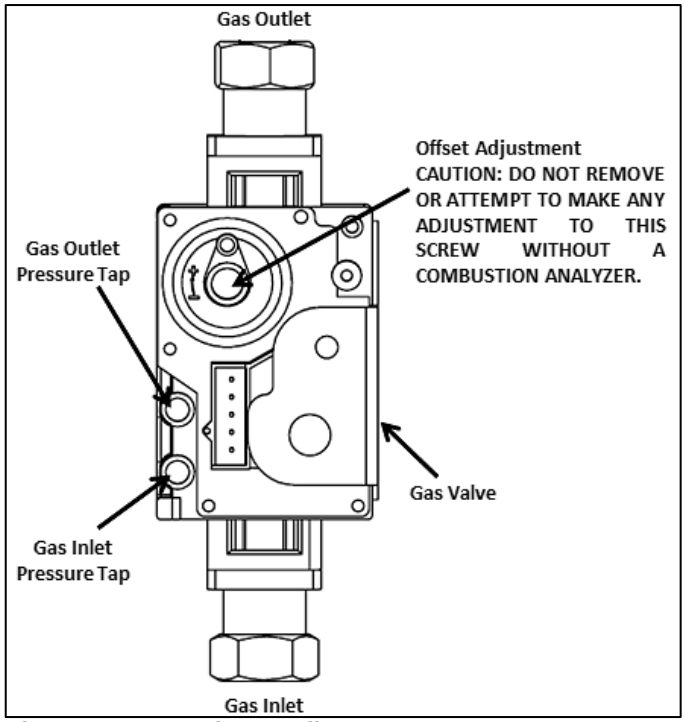


Figure 56 –Gas Valve Detail

H. FINAL CHECKS BEFORE STARTING BOILER

1. Verify the boiler and system are full of water and all system components are correctly set for operation.

2. Fill the condensate trap with water.

3. Verify electrical connections are correct and securely attached.

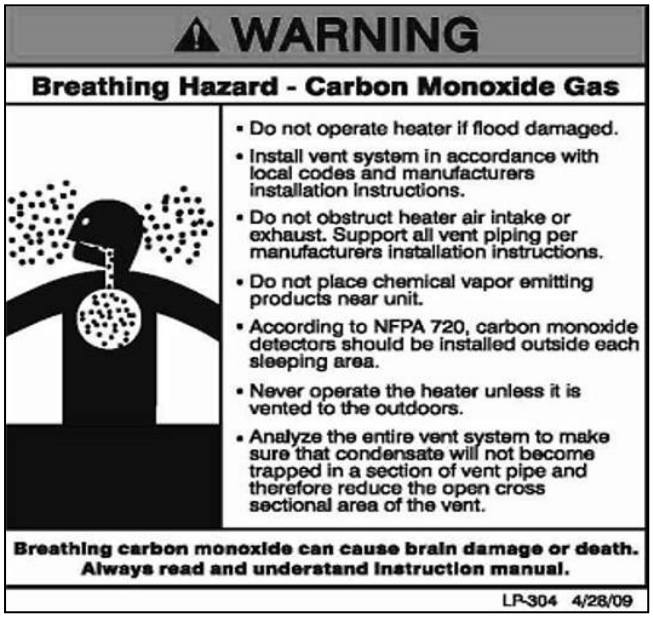
4. Inspect exhaust vent and intake piping for signs of deterioration from corrosion, physical damage, or sagging. Verify exhaust vent and intake piping are intact and correctly installed per Venting Section (this manual) and local codes.

I. ADJUSTING GAS PRESSURE AT THE BOILER

NOTE: Refer to Figure 56 when adjusting gas pressure. Loosen the screw 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).



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.

ADJUSTING GAS PRESSURE AT THE BOILER

1. Open the gas line and water valves.

2. Use a Phillips Head screwdriver to remove the boiler front cover. Remove the front cover.

3. Loosen the gas inlet pressure tap screw three turns a screwdriver. Connect the manometer to the inlet gas pressure port. See Figure 56.

4. Turn on power to the boiler and turn up the thermostat to make a call for heat.

5. The minimum and maximum inlet gas line pressures must meet the requirements shown in Table 29.

LP GAS		NATURAL GAS	
Minimum Pressure	3.5” WC	Minimum Pressure	3.5” WC
Maximum Pressure	14” WC	Maximum Pressure	14” WC

Table 29 – Gas Pressure Requirements

6. Remove the manometer. Close the screw on the gas inlet pressure tap.

J. SETTING AND VERIFYING THE COMBUSTION SETTING

1. After the boiler has fired, flip DIP switch seven (7) to the ON position (low fire). Proceed to check boiler combustion values.

NOTE: Use a combustion analyzer to ensure CO and CO_2 values are within the range shown in Table 30.

⚠ WARNING

It is required to use a combustion analyzer to verify final adjustment according to the combustion chart (Table 30). Failure to do so could result in serious personal injury or death.

If the readings obtained are lower or higher than the combustion readings in Table 30, use a 4mm Allen key to adjust the offset screw in a clockwise (positive) or counterclockwise (negative) direction (approximately 1/4 turn). See Figure 57. Check your combustion values. Repeat this procedure until the values obtained on the combustion analyzer agree with those stated in Table 30.

NOTE: If the boiler makes a whistling sound (harmonics) at low fire, adjust the offset screw in a clockwise (positive) direction (approximately 1/8 turn). Check your combustion values and ensure they agree with those stated in Table 30 before proceeding.

⚠ WARNING

It is very important that this conversion be set within the recommended CO measurements listed in Table 30. Visually looking at the burner does not determine combustion quality. Failure to measure combustion with a Combustion Analyzer and set the throttle within the recommended CO measurements could result in property damage, severe personal injury, or death.

COMBUSTION SETTINGS				
	NATURAL GAS		LP GAS	
FAN SPEED	**LOW**	**HIGH**	**LOW**	**HIGH**
CO PPM	≤175	≤175	≤175	≤175
CO_2 (%)	8 – 9 ½	8 ½ - 10	9 – 10 ½	9 ½ - 11

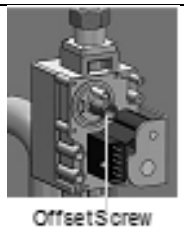


Figure 57 – Gas Valve Offset Screw

Table 30 – Combustion Settings

2. When low fire settings have been obtained, flip DIP switch seven (7) to its original (OFF) position. This will return the boiler to normal mode.

3. Flip DIP switch six (6) to ON (high fire). Again check combustion readings with a combustion analyzer.

4. When complete, flip DIP switch six (6) to its original (OFF) position. This will return the boiler to normal mode.

5. Allow boiler to operate normally. Ensure it is operating properly.

6. Reinstall the boiler front cover.

7. Use a Phillips Head screwdriver to reinstall the boiler top cover.

PART 12 –INSTALLATION AND START-UP CHECKLIST

LIGHT OFF ACTIVITIES		DATE COMPLETED	
		YES	NO
1) Fill the Heating System with Water	Has the system been cleaned and flushed?		
	Does water chemistry meet requirements?		
	If water chemistry does not meet requirements, have treatment measures been put in place?		
	Check all water piping and connections. Are all leak free and properly supported?		
	Has the CH system been pressure tested and pressurized to 12 – 25 psi?		
2) Exhaust Vent and Intake Piping	Has the boiler been vented in accordance with the methods and materials listed in this manual and to meet local codes (vented in approved materials, air supply sufficient for proper operation, combined vent length within the maximum vent length restriction, vent lengths minimized, installed with proper terminations, clearances, and pitch, etc.?		
	Is vent piping properly supported?		
	Has exhaust vent piping been checked for leaks?		
	Have the exhaust vent and intake pipes been properly installed into the connectors provided on the boiler?		
3) Condensate Piping / Tubing and Components	Have all condensate line components included with the boiler been installed?		
	Is the condensate line piped with the approved materials listed in this manual?		
	Has the condensate line been routed to a laundry tub or other drain?		
	If necessary, has a condensate pump and/or neutralizer been installed?		
4) Gas Piping	Has the gas supply line been piped in accordance with the methods listed in this manual (supply line no less than ½" in diameter, length and diameter adequate to deliver the required BTUs, union and shut-off valve installed, etc.)?		
	Does the gas type match the type indicated on the boiler rating plate?		
	Has gas supply line pressure been measured (between 3.5 and 14" WC)?		
	Has the gas supply line been leak tested per locally approved methods?		
5) Pressure Relief Valves	Have you installed approved pressure relief valves on the boiler?		
	Is the pressure relief valve in the CH line at least 1" in diameter and rated to 30 psi?		
6) Wire the Boiler	Have you connected the power and control wiring per boiler wiring diagram, this manual?		
	Have all DIP switches been set on the main boiler board?		
	Is electrical connection polarity within boiler requirements?		
	Do power specifications meet boiler requirements? 120V AC?		
7) Start-Up, Adjust, and Test	Has the boiler been started?		
	Has CO2 and CO been checked to ensure proper combustion?		
	If necessary, has the boiler gas valve been adjusted to achieve proper combustion?		
	Has the installation been customized per location requirements?		
	Have all customized system parameters been tested?		
	Has proper boiler operation been confirmed?		
	Has the burner flame been checked? Is the burner flame a proper blue color? See Figure 58 for flame sight glass window location.		
	If the flame does not appear normal, the combustion system may need to be cleaned or adjusted by a qualified service technician.		
FINAL INSTALLATION APPROVALS	**SIGNED BY TECHNICIAN**	**DATE**	

Table 31 – Final Installation Checklist

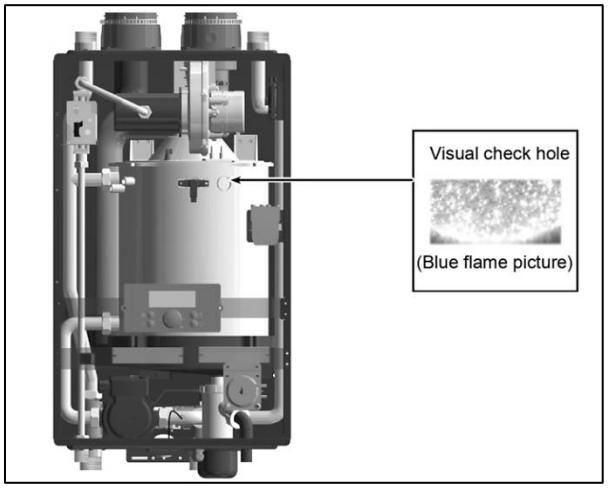


Figure 58 – Flame Sight Glass

CH Return Temperature Sensor (7855P-097) Exhaust Temperature Sensor (7855P-092)		CH Supply Temperature Sensor (7855P-030)		Outdoor Temperature Sensor (7855P-084)		Indirect Tank Sensor (7250-325)	
Temperature (◦F)	**Resistance (Ω)**	**Temperature (◦F)**	**Resistance (Ω)**	**Outside Temperature (◦F)**	**Resistance (Ω)**	**Temperature (◦F)**	**Resistance (Ω)**
-4	62162	-4	28409	-4	99200	32	32624
5	48440	5	22152	5	74229	41	25381
14	38045	14	17408	14	56090	50	19897
23	30107	23	13782	23	42790	59	15711
32	23998	32	10990	32	32930	68	12493
41	19261	41	8824	41	25550	77	10000
50	15562	50	7131	50	19990	86	8056
59	12655	59	5800	59	15760	95	6530
68	10353	68	4747	68	12510	104	5324
77	8520	77	3906	77	10000	113	4365
86	7051	86	3233	86	8050	122	3599
95	5867	95	2690	95	6520	131	2982
104	4908	104	2250	104	5310	140	2483
113	4125	113	1891	113	4350	149	2079
122	3485	122	1598	122	3590	158	1748
131	2957	131	1356			167	1476
140	2520	140	1155			176	1252
149	2157	149	989			185	1066
158	1854	158	850			194	912
167	1600	167	733			203	782
176	1386	176	635			212	674
185	1205	185	552				
194	1051	194	482				
203	920	203	421				
212	808	212	370				

Table 32 – Temperature Sensor Resistance

PART 13 – TROUBLESHOOTING

TROUBLESHOOTING CHART		
PROBLEM	**POSSIBLE CAUSES**	**POSSIBLE REMEDIES**
No electrical power to the boiler	1. Is the plug on the power supply cord unplugged from the electrical outlet? 2. Is electrical panel's 10 Amp circuit breaker tripped? 3. Is the fuse on the circuit board good? 4. Is there a power outage to the home?	1. Reset the plug. 2. Reset the circuit breaker. 3. If the display panel is blank, unplug the unit or contact an authorized service technician. 4. Contact the power company.
A fan can be heard even when the unit is not operating.	1. The fan continues to operate after the burner shuts off to clear the exhaust vent of combustion gases. 2. The fan may run to help prevent freezing.	1. This is normal operation – no action is required. 2. Protect the boiler from freezing temperatures or shut off and drain the unit.
White "smoke" can be seen coming out of the exterior exhaust gas vent.	Depending on the outside temperature, water vapor can be produced as the exhaust is vented.	This is normal operation – no action is required.
No domestic hot water	Is the indirect water temperature set too low?	Adjust the temperature setting.
Domestic hot water is too hot	Is the indirect water temperature set too high?	Adjust the temperature setting.
House is not heating up	Is the CH temperature set too low?	Adjust the temperature setting.

Table 33 – Troubleshooting Chart

PART 14 – ANNUAL MAINTENANCE PROCEDURES

⚠ 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.

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 7 from the area surrounding the boiler and the vicinity of the combustion air intake. If contaminates are found:

- Remove products immediately from area.
- If contaminates 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.

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 Contaminates

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 contaminates and areas likely to have these contaminates in Table 7. If any of these contaminates are in the room where the boiler is located, or combustion air is taken from one of the areas listed, the contaminates must be removed immediately or the intake pipe must be relocated to another area.

Ensure the Boiler Cabinet is Closed

Ensure the boiler cabinet is closed. Tighten the two upper and lower screws to secure it. The cabinet must be closed while the boiler is running.

Check the Power Source

Make sure the power cord is properly connected. The main power line is 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 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 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.
- Contact a qualified service technician if problem persists.

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.

Visually inspect the intake piping for any signs of blockage. Inspect the entire length of the intake pipe to ensure piping is intact and all joints are properly sealed. Inspect the intake pipe bracing. Ensure bracing is undamaged and in good condition. Notify a qualified service technician if any problems are found.

Check Pressure Relief Valve
- Visually inspect the primary pressure relief valve and discharge pipe for signs of weeping or leakage.
- 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.

Check Vent Condensate Drain System
- 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.
- 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.
- If applicable, check the condensate neutralizer and ensure it is full of condensate neutralizing marble chips.

Check Primary and Gas Piping
- Remove the boiler cover and perform a gas leak inspection following Operating Instructions, page 2, this manual. If gas odor or leak is detected, follow procedures on page 2. Call a qualified service technician.
- Visually inspect for leaks around the internal 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.

Operate Pressure Relief Valve
- 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.

⚠ 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 or heating/plumbing installer 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.

- Read the temperature and pressure gauge to ensure the system is pressurized. Minimum is 10 psi. Maximum is 25 psi. Lift the relief valve top lever slightly, allowing water to relieve through the valve and discharge piping.
- 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.

- 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.

Check the Burner
Clean the exterior of the burner.

Flushing the CH Closed Loop Heat Exchanger
Flushing the heat exchanger is a complicated procedure that should only be performed by a qualified service technician. It is recommended to flush the heat exchanger annually if water hardness exceeds 12 grains per gallon (considered extremely hard water). If water hardness falls below 12 grains per gallon it is recommended to flush the heat exchanger every two to three years.

NOTE: Improper maintenance WILL VOID boiler warranty.

1. Disconnect electrical power to the boiler.

2. Close the shutoff valves on both CH supply and CH return lines (V1 and V2). See Figure 59.

3. Connect one hose (D1, Figure 59) to the valve (V3) and place the free end in a bucket. Connect one of the hoses (D3) to the circulation pump outlet and the cold water inlet line to valve V4. Connect the other hose (D2) to the circulation pump inlet and place the free end in the bucket.

4. Pour tankless cleaning solution into the bucket. Use an FDA approved cleaner for potable systems on the heat exchanger. Place the drain hose (D1) and hose D2 to the pump inlet in the cleaning solution.

5. Open service valves (V3 and V4) on the hot water outlet and cold water inlet lines.

6. Turn on the circulation pump. Operate the pump and allow the cleaning solution to circulate through the boiler for at least 1 hour at a rate of 4 gallons per minute.

7. Rinse the cleaning solution from the heat exchanger as follows:
   a. Remove the free end of drain hose D1 from the bucket.
   b. Close service valve V4 and open shutoff valve V2.
   c. Do not open shutoff valve V1.
   d. Allow water to flow through the boiler for 5 minutes.
   e. Close shutoff valve V2.

8. Disconnect hoses from lines. Properly dispose of used cleaning solution.

9. Remove the CH filter from the boiler and clean out any residues.

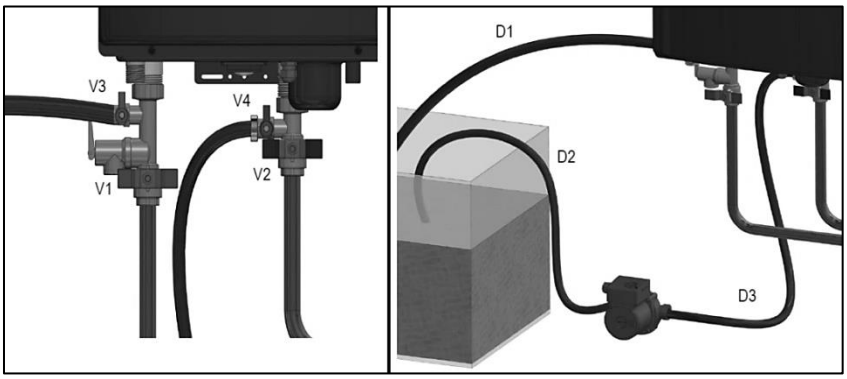


Figure 59 – A – Valve, and B – Hose Connection Details

Maintaining the Condensate System

⚠ DANGER

The condensate trap assembly MUST BE PROPERLY INSTALLED according to these instructions when operating the boiler. Operating the boiler without the condensate trap assembly will cause flue gases to leak and result in serious personal injury or death.

⚠ WARNING

When servicing is complete, make sure the condensate collector cap is replaced securely. Failure to do so will cause venting issues that will result in serious injury or death.

1. Ensure the boiler is powered off and has had time to cool.

2. Remove the hose clamp attaching the condensate trap to the condensate hose from the heat exchanger. Remove the clear plastic hose from the hose barb. Remove the condensate hose clamp to detach the condensate trap from the drain tube. Remove the condensate trap from the boiler.

3. Remove the bottom cap from the condensate trap.

4. Flush trap with fresh water to remove debris from the trap.

NOTE: Ensure the float moves freely within the trap. If the float does not move, DO NOT reinstall the trap.

5. When the condensate trap is sufficiently clean, reinstall the bottom cap on the trap.

NOTE: Ensure all parts shown in Figure 60, Condensate Detail, are installed with the condensate trap. If any parts are missing, DO NOT reinstall the trap. Replace the entire assembly.

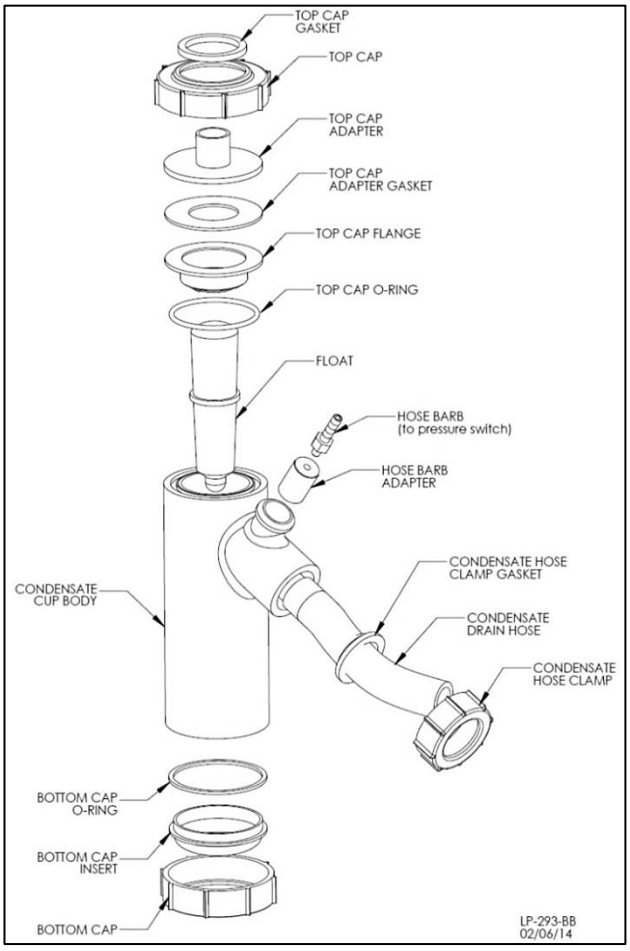


Figure 60 – Condensate Detail

⚠ 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.

6. Fill the condensate trap with fresh water prior to reassembly on the boiler.

7. Install the condensate trap on the condensate hose from the heat exchanger. Use the hose clamp to secure the trap. Attach the clear plastic hose onto the hose barb. Reinstall the condensate hose clamp to detach the condensate trap from the drain tube.

⚠ WARNING

Do not operate the boiler without the clear hose attached from the hose barb to the pressure switch. Failure to follow this warning could result in property damage, serious personal injury, or death.

8. If a condensate neutralizer kit is installed with the boiler, 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 (for piping details, refer to condensate neutralizer installation instruction.)

9. Check condensate piping for sagging and/or leakage. Repair any sags or leaks before restoring power to the boiler.

CAUTION

It is very important that the condensate piping be no smaller than ¾". To prevent sagging and maintain pitch, condensate piping should be supported with pipe supports, and pitched ¼" per foot to allow for proper drainage.

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate freezes in the line, or if line is obstructed in any other manner, condensate can exit from the tee, resulting in potential water damage to property.

10. If the boiler has a condensate pump, ensure the pump operates properly before considering maintenance complete.

REPLACEMENT PARTS

NUMBER	DESCRIPTION	PART NUMBER	NUMBER	DESCRIPTION	PART NUMBER
B-1	M3 X 6 PH + MS	7855P-384	B-10	M4 X 12 TH + M/S	7855P-393
B-2	M4 X 8 PH + Self Tapping	7855P-385	B-11	M4 X 14 PH + Self Tapping	7855P-394
B-3	M4 X 8 TH + Self Tapping	7855P-386	B-12	M4 X 15 PW + M/S	7855P-395
B-4	M4 X 8 TH + MS	7855P-387	B-13	M4 X 20 TH + Self Tapping	7855P-396
B-5	M4 X 10 FH + M/S	7855P-388	B-14	M5 X 14 Flange Bolts M/S	7855P-397
B-6	M4 X 10 TH + Self Tapping	7855P-389	B-15	M5 X 10 TH+ M/S	7855P-453
B-7	M4 X 10 TH + M/S	7855P-390	N-1	M4 Nut	7855P-398
B-8	M4 X 10 Flat Head	7855P-391	N-2	M5 Nut	7855P-399
B-9	M4 X 12 PH + M/S	7855P-392			

Table 34 – Replacement Bolts and Nuts

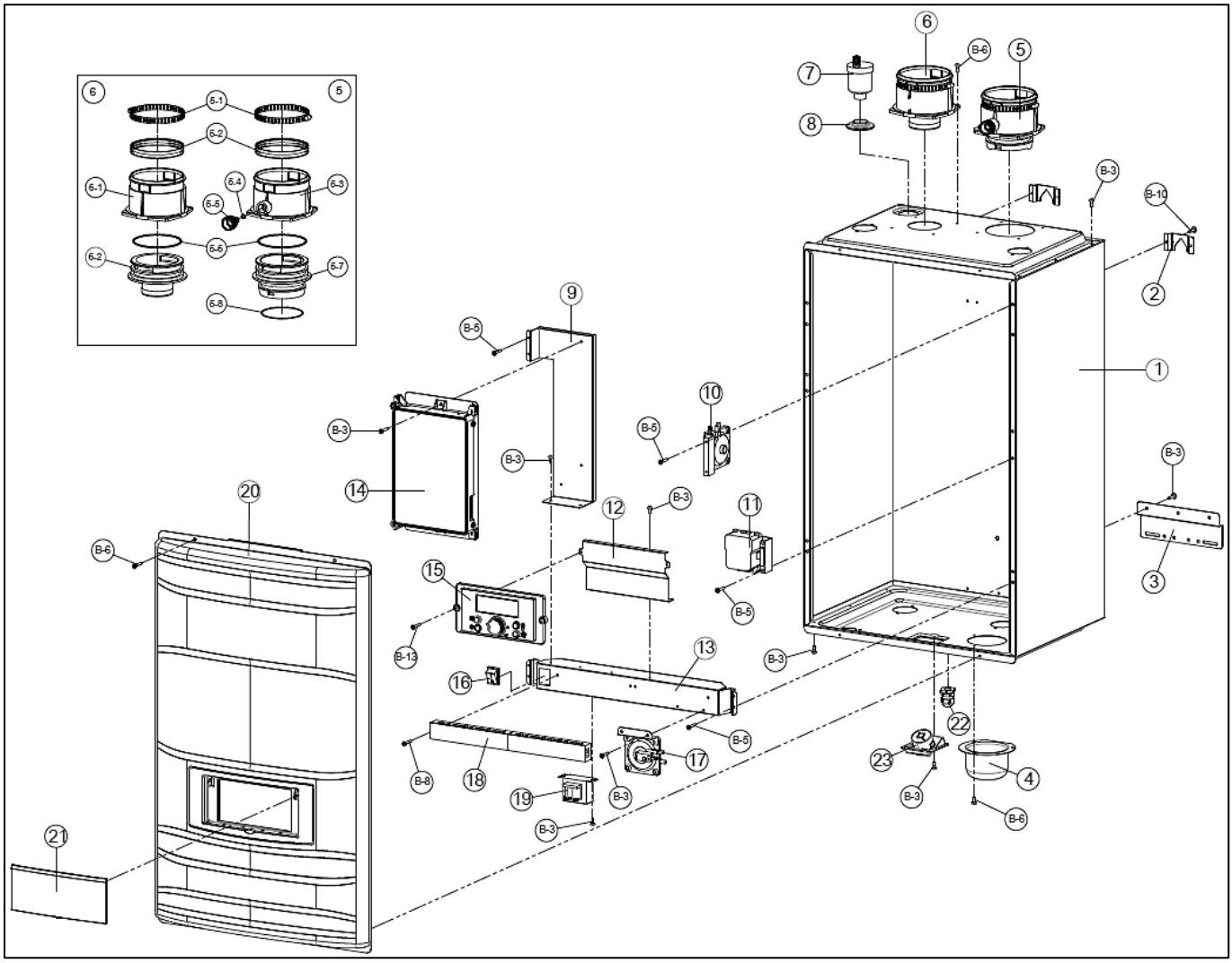


Figure 61 – Cabinet Replacement Parts – 80 – 140W Models

NUMBER	DESCRIPTION	PART NUMBER	NUMBER	DESCRIPTION		PART NUMBER
1	Cabinet Assembly	7855P-330	8	Air Vent Grommet		7855P-339
2	Top Wall Mount Bracket	7850P-068	9	Control Board Bracket		7855P-340
3	Bottom Wall Mount Bracket	7850P-092	10	Air Pressure Switch		7855P-262
4	Condensate Trap Cup	7855P-331	11	Ignition Transformer		7855P-007
5	Exhaust Duct (Assembly)	7855P-002	12	Display Panel Bracket		7855P-341
5-1	Exhaust / Intake Duct Clamps	7855P-332	13	Terminal Blocks Bracket		7855P-342
5-2	Exhaust / Intake Gaskets	7850P-210	14	Control Board	80W	7855P-308
					100W	7855P-309
					120W	7855P-310
					140W	7855P-311
5-3	Exhaust Duct	7855P-333	15	Display Panel		7855P-344
5-4	Combustion Analyzer Port Plug O-Ring	7855P-334	16	Manual Power Switch		7855P-014
5-5	Combustion Analyzer Port Plug	7855P-335	17	Condensate Block APS		7855P-017
5-6	Intake and Exhaust Adapter O-Ring	7855P-256	18	Terminal Block		7855P-345
5-7	Exhaust Duct Inner Adapter	7855P-004	19	Transformer		7855P-346
5-8	Exhaust Adapter O-Ring	7855P-254	20	Cabinet Front Cover		7855P-347
6	Air Intake Assembly	7855P-003	21	Display Panel Cover		7850P-023
6-1	Air Intake Cap	7855P-337	22	Wire Gland		7855P-348
6-2	Air Intake Inner Adapter	7855P-338	23	CH Pressure Gauge		7855P-222
7	Air Vent	7855P-063				

Table 35 – Cabinet Replacement Parts – 80 – 140W Models

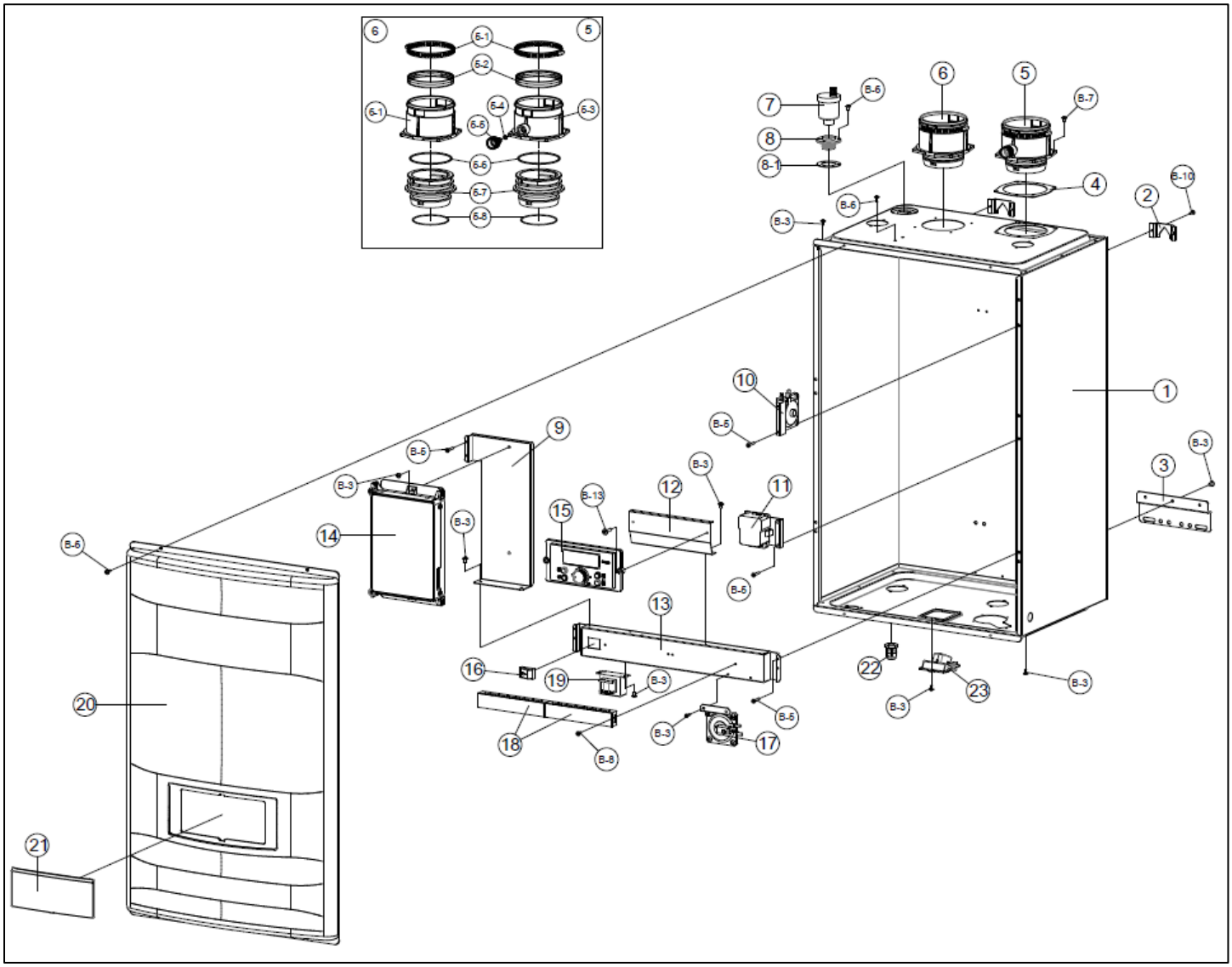


Figure 62 – Cabinet Replacement Parts – 175 – 199W Models

NUMBER	DESCRIPTION	PART NUMBER	NUMBER	DESCRIPTION		PART NUMBER
1	Cabinet Assembly	7855P-410	8	Air Vent Adapter		7855P-454
2	Top Wall Mount Bracket	7850P-068	8-1	Air Vent Grommet		7855P-339
3	Bottom Wall Mount Bracket	7850P-092	9	Control Board Bracket		7855P-412
4	Exhaust Adapter Sealing Gasket	7850P-041	10	Air Pressure Switch		7855P-262
5	Exhaust Duct (Assembly)	7855P-002	11	Ignition Transformer		7855P-007
5-1	Exhaust / Intake Duct Clamps	7855P-332	12	Display Panel Bracket		7855P-413
5-2	Exhaust / Intake Gaskets	7850P-210	13	Terminal Blocks Bracket		7855P-434
5-3	Exhaust Duct	7855P-333	14	Control Board	175W	7855P-404
					199W	7855P-405
5-4	Combustion Analyzer Port Plug O-Ring	7855P-334	15	Display Panel		7855P-344
5-5	Combustion Analyzer Port Plug	7855P-335	16	Manual Power Switch		7855P-014
5-6	Intake and Exhaust Adapter O-Ring	7855P-256	17	Condensate Block APS		7855P-017
5-7	Exhaust Duct Inner Adapter	7855P-004	18	Terminal Block		7855P-345
5-8	Exhaust Adapter O-Ring	7855P-254	19	Transformer		7855P-346
6	Air Intake Assembly	7855P-411	20	Cabinet Front Cover		7855P-414
6-1	Air Intake Cap	7855P-337	21	Display Panel Cover		7850P-023
6-2	Air Intake Inner Adapter	7855P-004	22	Wire Gland		7855P-348
7	Air Vent	7855P-063	23	CH Pressure Gauge		7855P-222

Table 36 – Cabinet Replacement Parts – 175 – 199W Models

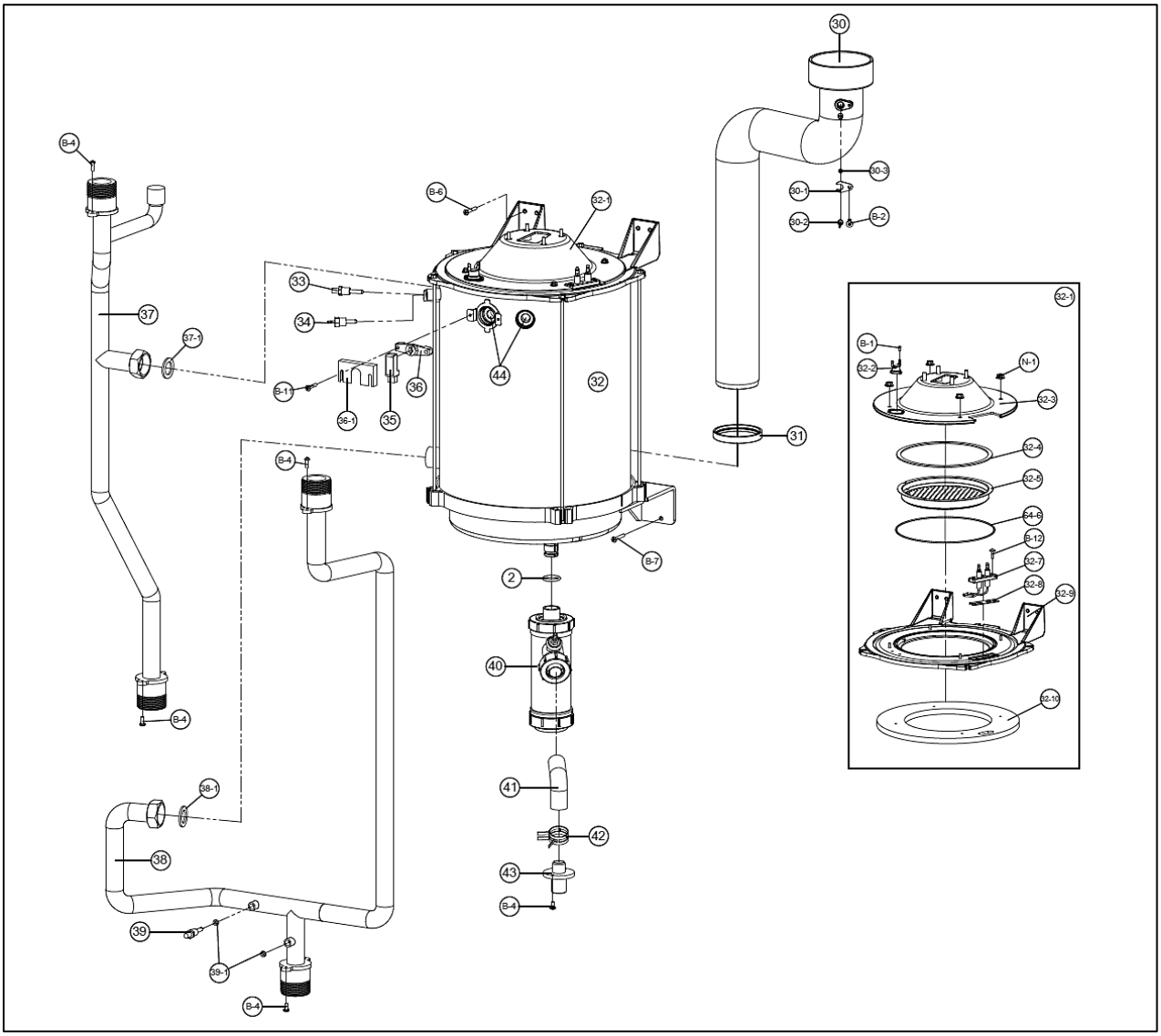


Figure 63 – Heat Exchanger Replacement Parts – 80W – 140W Models

NUMBER	DESCRIPTION		PART NUMBER	NUMBER	DESCRIPTION		PART NUMBER
30	Exhaust Pipe Assembly		7855P-237	33	CH Supply Temperature Sensor		7855P-030
30-1	Exhaust Temperature Sensor Clip		7855P-349	34	Water Level Detection Sensor (Low Water Cut-Off)		7855P-029
30-2	Exhaust Temperature Sensor		7855P-092	35	Flame Sensor		7855P-031
30-3	Exhaust Temperature Sensor O-Ring			36	Flame Sensor Bracket		7855P-356
31	Exhaust Pipe Gasket		7855P-351	36-1	Flame Sensor Cover		7855P-357
32	Heat Exchanger Assembly	80W / 100W	7855P-352	37	CH Supply Pipe	80W / 100W	7855P-358
		120W / 140W	7855P-353			120W / 140W	7855P-359
32-1	Burner Body Assembly		7855P-354	37-1	CH Supply Pipe Gasket		7855P-074
32-2	Burner Overheat Sensor		7855P-066	38	CH Return Pipe		7855P-361
32-3	Burner Body		7855P-067	38-1	CH Return Pipe Gasket		7855P-074
32-4	Burner Gasket		7855P-266	39	CH Return Sensor		7855P-097
32-5	Ceramic Fiber Burner		7855P-069	39-1	CH Return Sensor Gasket		7855P-364
32-6	Burner Plate O-Ring		7855P-249	40	Condensate Trap Assembly		7855P-053
32-7	Ignition Rod		7855P-068	41	Condensate Trap Drain Hose		7855P-255
32-8	Igniter Gasket		7855P-252	42	Condensate Trap Clamp		7855P-366
32-9	Heat Exchanger Top		7855P-355	43	Condensate Outlet Adapter		7855P-224
32-10	Burner Refractory		7855P-253	44	Sight Glass		7855P-401

Table 37 – Heat Exchanger Replacement Parts – 80W – 140W Models

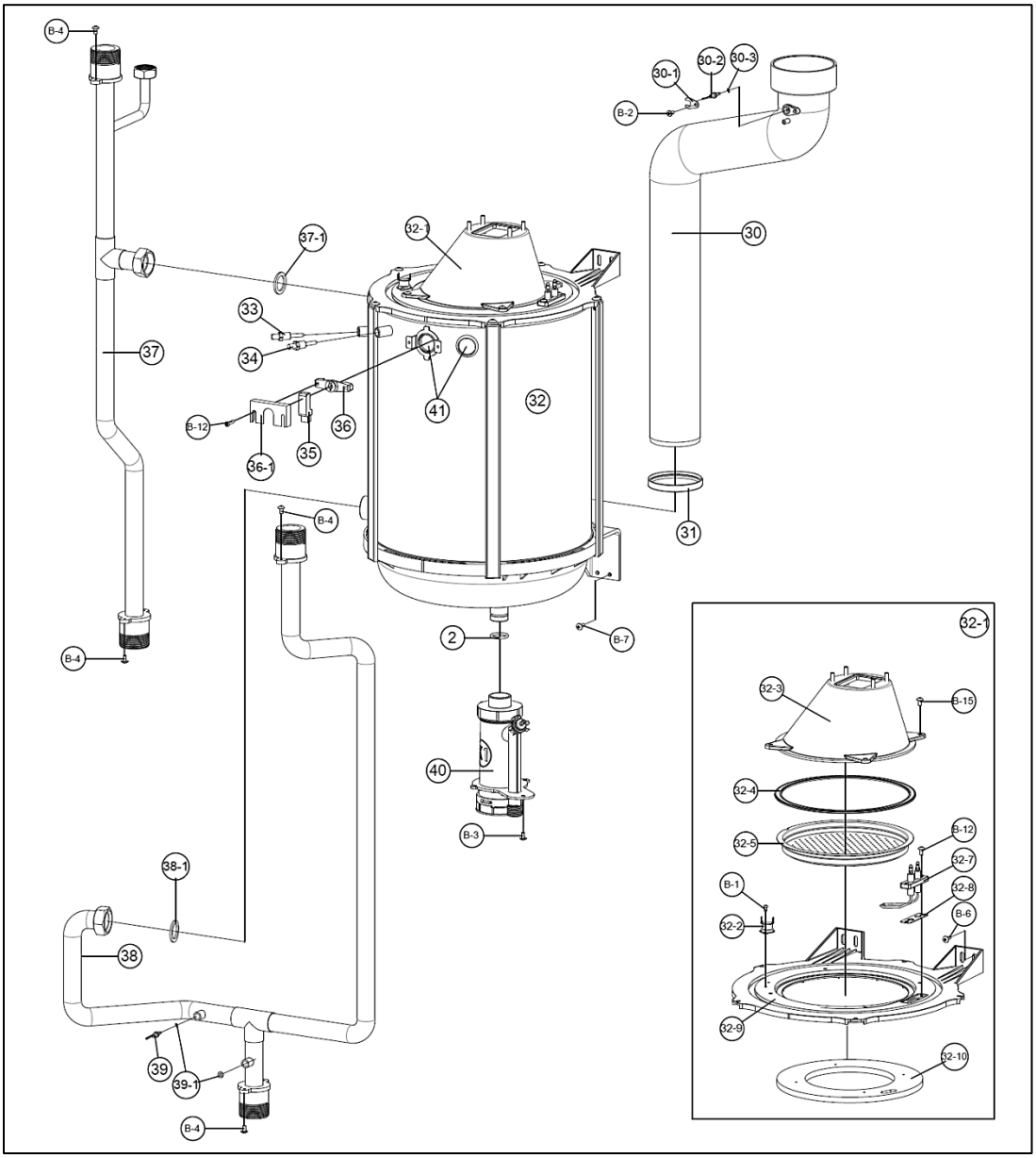


Figure 64 – Heat Exchanger Replacement Parts – 175W – 199W Models

NUMBER	DESCRIPTION	PART NUMBER	NUMBER	DESCRIPTION	PART NUMBER
30	Exhaust Pipe Assembly	7855P-415	32-10	Burner Refractory	7855P-612
30-1	Exhaust Temperature Sensor Clip	7855P-349	33	CH Supply Temperature Sensor	7855P-030
30-2	Exhaust Temperature Sensor	7855P-092	34	Water Level Detection Sensor (Low Water Cut-Off)	7855P-029
30-3	Exhaust Temperature Sensor O-Ring				
31	Exhaust Pipe Gasket	7855P-418	35	Flame Sensor	7855P-031
32	Heat Exchanger Assembly	7855P-416	36	Flame Sensor Bracket	7855P-356
32-1	Burner Body Assembly	7855P-417	36-1	Flame Sensor Cover	7855P-357
32-2	Burner Overheat Sensor	7855P-066	37	CH Supply Pipe	7855P-421
32-3	Burner Body	7855P-606	37-1	CH Supply Pipe Gasket	7855P-074
32-4	Burner Gasket	7855P-419	38	CH Return Pipe	7855P-422
32-5	Ceramic Fiber Burner	7855P-420	38-1	CH Return Pipe Gasket	7855P-074
32-6	Burner Plate O-Ring	7855P-249	39	CH Return Sensor	7855P-097
32-7	Ignition Rod	7855P-607	39-1	CH Return Sensor Gasket	7855P-364
32-8	Igniter Gasket	7855P-252	40	Condensate Trap Assembly	7855P-605
32-9	Heat Exchanger Top	7855P-619	41	Sight Glass	7855P-401

Table 38 – Heat Exchanger Replacement Parts – 175W – 199W Models

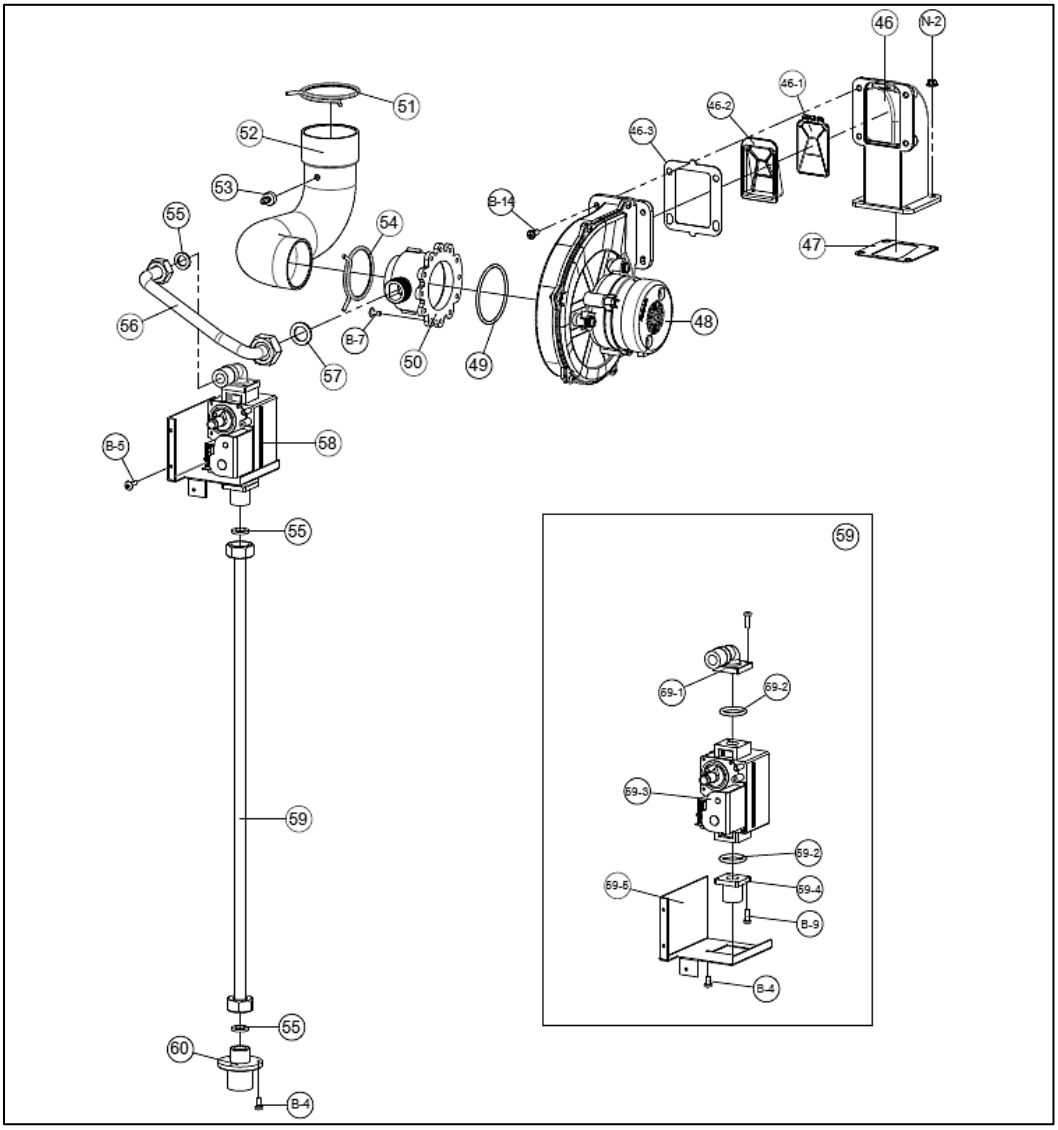


Figure 65 – Combustion System Replacement Parts – 80W – 140W Models

#	DESCRIPTION	PART NUMBER			#	DESCRIPTION	PART NUMBER	
46	Burner Inlet Channel (with Damper)	7855P-367			55	½" Gas Pipe Gasket	7855P-221	
46-1	Air Damper	7855P-368			56	Gas Pipe (to Mixer)	**80W / 100W**	7855P-377
46-2	Air Damper Guide	7855P-369					**120W / 140W**	7855P-378
46-3	Fan Outlet Gasket	7855P-425			57	¾" Gas Pipe Gasket	7855P-379	
47	Burner Inlet Channel Gasket	7855P-370			58	Gas Pipe (to Gas Valve)	7855P-380	
48	Fan	7855P-025			59	Gas Valve Assembly	7855P-381	
49	Fan O-Ring	7855P-371			59-1	Gas Valve Outlet Adapter	7855P-232	
50	Mixer	**Model**	**NG**	**LP**	59-2	Gas Valve O-Ring	7855P-076	
		80W	7855P-300	7855P-301				
		100W	7855P-302	7855P-303				
		120W	7855P-316	7855P-305				
		140W	7855P-317	7855P-307				
51	Air Intake Hose Top Clamp	7855P-372			59-3	Gas Valve	7855P-034	
52	Air Intake Hose	**80W /100W**		7855P-373	59-4	Gas Valve Inlet Adapter	7855P-033	
		120W / 140W		7855P-374				
53	APS Hose Fitting	7855P-375			59-5	Gas Valve Bracket	7855P-234	
54	Mixer Clamp	7855P-376			60	Gas Inlet Adapter (3/4")	7855P-382	

Table 39 – Combustion System Replacement Parts – 80W – 140W Models

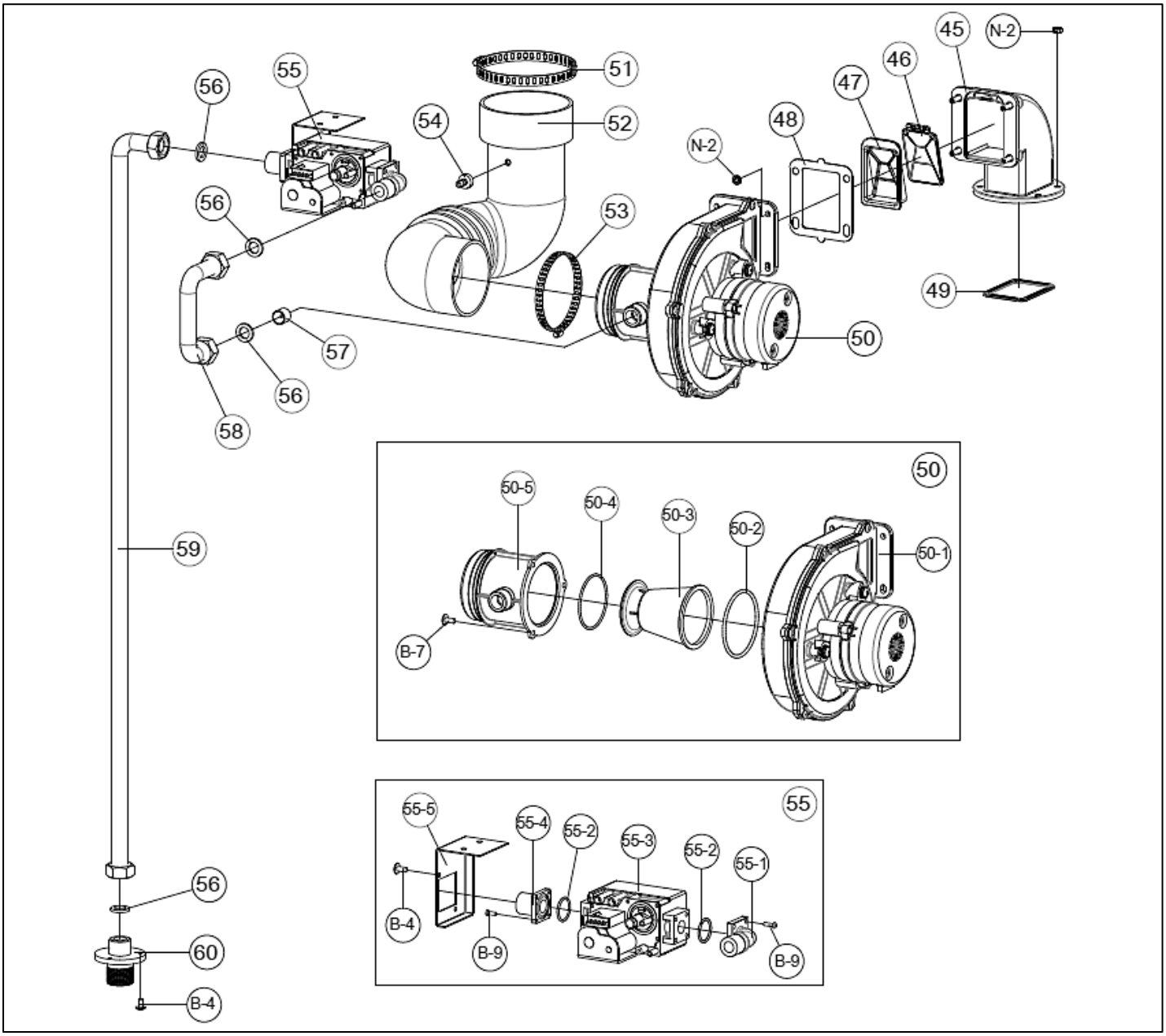


Figure 66 – Combustion System Replacement Parts – 175W – 199W Models

#	DESCRIPTION	PART NUMBER	#	DESCRIPTION	PART NUMBER
45	Burner Inlet Channel (with Damper)	7855P-424	55	Gas Valve Assembly	7855P-431
46	Air Damper	7855P-618	55-1	Gas Valve Outlet Adapter	7855P-232
47	Air Damper Guide	7855P-369	55-2	Gas Valve O-Ring	7855P-076
48	Fan Outlet Gasket	7855P-425	55-3	Gas Valve	7855P-034
49	Burner Inlet Channel Gasket	7855P-426	55-4	Gas Valve Inlet Adapter	7850P-077
50	Fan and Mixer Assembly	7855P-427	55-5	Gas Valve Bracket	7855P-436
50-1	Fan	7855P-025	56	½" Gas Pipe Gasket	7855P-221
50-2	Fan O-Ring	7855P-371	57	Gas Orifice (NG) 8.3 mm	7855P-610
50-3	Air-Gas Mixer (Inner Part)	7855P-609		Gas Orifice (LP) 6.3 mm	7855P-435
50-4	Air-Gas Mixer Gasket	7855P-428	58	Gas Pipe (to Mixer)	7855P-432
50-5	Air-Gas Mixer (Outer Part)	7855P-608	59	Gas Pipe (to Gas Valve)	7855P-433
51	Air Intake Hose Top Clamp	7855P-429	60	Gas Inlet Adapter (3/4")	7855P-382
52	Air Intake Hose	7855P-430			
53	Air Intake Hose (Bottom Clamp)	7855P-429			
54	APS Hose Fitting	7855P-375			

Table 40 – Combustion System Replacement Parts – 175W – 199W Models

Limited Warranty for UFT Boilers

HTP warrants each boiler and its parts to be free from defects in materials 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 owner** of this boiler, and is non-transferable.

Residential Use Warranty	Commercial Use Warranty
10 years – Heat Exchanger, 5 years – Parts	**5 years – Heat Exchanger, 1 Year – Parts**
USE DEFINTIONS - Residential Use means potable water heating in a single family dwelling. This dwelling must be either: a) owned and resided in by the original purchaser; or b) a residential rental property that services a single dwelling in which the original purchaser resides on a permanent basis. Commercial Use refers to all other applications.	

COVERAGE

A. During the first year after the original date of installation, HTP warrants that it will repair or replace, at its option, any defective or malfunctioning component of the boiler with a component of equivalent size and current model. Replacement components will be warranted for ninety (90) days.
B. Should a defect or malfunction result in a leakage of water within the above-stated warranty periods due to defective material or workmanship, malfunction, or failure to comply with the above warranty, HTP will replace the defective or malfunctioning boiler with a replacement of the nearest comparable model available at the time of replacement. The replacement boiler will be warranted for the unexpired portion of the applicable warranty period of the original boiler.
C. In the event of a leakage of water of a replacement boiler due to defective material or workmanship, malfunction, or failure to comply with the above warranty, HTP reserves the right to refund to the original purchaser the published wholesale price available at the date of manufacture of the original boiler.
D. If government regulations, industry certification, or similar standards require the replacement boiler or part(s) to have features not found in the defective boiler or part(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 a new replacement boiler or part(s), the owner will also receive a complete new limited warranty for that replacement boiler or part(s).
E. If at the time of a request for service the owner cannot provide a copy of the original sales receipt or the warranty registration, the warranty period for the boiler shall then be deemed to have commenced thirty (30) days after the date of manufacture of the boiler and **NOT** the date of installation of the boiler.
F. 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.
G. It is expressly agreed between HTP and the original consumer purchaser that repair, replacement, or refund are the exclusive remedies of the original consumer purchaser.

OWNER RESPONSIBILITIES

To avoid the exclusion list in this warranty, the owner or installer must:
1. 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 your boiler and keep it running at optimum efficiency.
2. Maintain all related system components in good operating condition.
3. If the cold water supply line has a backflow preventer, then an expansion tank should be installed to allow for water expansion.
4. Use the boiler at water pressures not exceeding the working pressure shown on the rating plate.

WARRANTY EXCLUSIONS

This limited warranty will not cover:
1. Any boiler purchased from an unauthorized dealer or online retailer.
2. Any boiler not installed by a qualified heating installer/service technician, or installations that do not conform to ANSI, CSA, and/or ETL standards, as well as any applicable national or local building codes.
3. Service trips to teach you how to install, use, maintain, or to bring the boiler installation into compliance with local building codes and regulations.
4. Failure to locate the boiler in an area where leakage of the tank or water line connections and the combination temperature and relief valve will not result in damage to the area adjacent to the boiler or lower floors of the structure.
5. Any failed components of the heat system not manufactured by HTP as part of the boiler.
6. Boilers repaired or altered without the prior written approval of HTP.
7. 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.
8. Damages, malfunctions, or failures resulting from improper installation, failure to operate the boiler at pressures not exceeding the working pressure shown on the rating plate, or failure to operate and maintain the boiler in accordance with the manufacturer's provided instructions.
9. Failure to operate the boiler in an open system with a properly sized and installed thermal expansion tank.
10. 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.
11. Damages, malfunctions, or failures caused by improper conversion from natural gas to LP gas or LP gas to natural gas.

12. Damages, malfunctions, or failures caused by operating the boiler with modified, altered, or unapproved parts.
13. Damages, malfunctions, or failures caused by abuse, accident, fire, flood, freeze, lightning, acts of God and the like.
14. Tank failures (leaks) caused by operating the boiler in a corrosive or contaminated atmosphere.
15. Damages, malfunctions, or failures caused by operating the boiler with an empty or partially empty tank ("dry firing"), or failures caused by operating the boiler when it is not supplied with water, free to circulate at all times.
16. Failure of the boiler due to the accumulation of solid materials and lime deposits.
17. Any damage or failure resulting from improper water chemistry, or heating anything other than potable water. DEFINITION OF POTABLE WATER - Potable water is defined as drinkable water supplied from utility or well water in compliance with EPA secondary maximum contaminant levels (40 CFR Part 143.3) as shown in the table.
18. Components of the boiler that are not defective, but must be replaced during the warranty period as a result of reasonable wear and tear.
19. Damages, malfunctions, or failures caused by subjecting the boiler to pressures or firing rates greater than those shown on the rating label.
20. Damages, malfunctions, or failures resulting from the use of any attachment(s) not supplied by HTP.
21. Boilers moved from the original installation location.
22. Boilers that have had their rating labels removed.

EPA DEFINITION OF POTABLE WATER	
Contaminant	**Level**
Total Hardness (Residential Use - Below 140°F water temperature)	200 mg/l (12 grains/gallon)
Total Hardness (Commercial Use - 140°F and above water temperature)	120 mg/l (7 grains/gallon)
Aluminum	0.05 to 0.2 mg/l
Chloride	100 mg/l
Color	15 color units
Copper	1.0 mg/l
Corrosivity	Non-corrosive
Fluoride	2.0 mg/l
Foaming Agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 threshold odor number
pH	6.5 – 8.5
Silver	0.1 mg/l
Sulfate	250 mg/l
Total Dissolved Solids (TDS)	500 mg/l
Zinc	5 mg/l
Dissolved Carbon Dioxide (CO2)	15 mg/l or ppm

PROCEDURES FOR WARRANTY SERVICE REQUESTS

Any claim for warranty assistance must be made promptly. Determine if the boiler is "in-warranty" (that is, within the applicable warranty period) by reviewing a copy of the original sales receipt or warranty registration. The owner must present a copy of the original sales receipt or warranty registration for a warranty service request.
If the boiler is "in-warranty", contact the distributor from whom the boiler was purchased (or the installer) for assistance. Be prepared to provide the retailer or installer with a copy of the original receipt, complete model and serial numbers, and the date of installation of the boiler, in addition to explanation of the boiler problem.
Warranty coverage is subject to validation of "in-warranty" coverage by HTP claims department personnel. All alleged defective or malfunctioning parts must be returned to HTP via the **local distribution channels** where original purchase was made. **NOTE: Any parts or boilers returned to HTP for warranty analysis will become the property of HTP and will not be returned, even if credit is denied.** If all warranty conditions are satisfied, HTP will provide replacement parts to the retailer.
For 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

This limited warranty does not extend to any shipping charges, delivery expenses, or administrative fees incurred by the owner in repairing or replacing the boiler or part(s). This warranty does not extend to labor costs beyond the coverage specified in this warranty document. All such expenses are the owner's responsibility.

LIMITATIONS OF YOUR HTP WARRANTY AND REMEDIES

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE GIVEN AND ACCEPTED 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 PURCHASER 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 PURCHASER ONLY.

NO OTHER WARRANTIES

This HTP Warranty gives you specific legal rights, and you 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 you.
These are the only written warranties applicable to the commercial 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 commercial boilers. HTP reserves the right to change specifications or discontinue models without notice.

START-UP REPORT

LIGHT OFF ACTIVITIES	**DATE COMPLETED** _____

		Yes	No		
1) Fill the heating system	Check all piping and gas connections, verify all are tight				
	Has the system been cleaned and flushed?				
	Has the boiler and the system been purged of all air? Refer to Start-Up Preparation, this manual.				
	Has the auto air purge feature been used / set? Refer to Start-Up Preparation, this manual.				
	Pressurize system (12 – 25 psi) CH	____ PSI			
	Add water to prime condensate cup				
	Percentage of glycol in system (0 – 50%)	____ %			
	Verify proper near boiler piping (Primary/Secondary)				
2) Electrical	Have the power and control wiring been connected per the wiring diagram in this manual?				
	Is the supply voltage 120v and polarity correct?				
3) Check gas pipe	Leak test using locally approved methods (consult jurisdictional code book)				
	Has the gas supply line been verified to deliver the required BTU of the boiler?				
	Has a union and shut-off valve (no less than ½") been installed?				
	Does the gas type match the type indicated on the rating plate?				
	Check incoming gas pressure (3.5" to 14" W.C.)	____ in w.c.	Static		
	Locate the stickers in the appropriate locations on the boiler				
	If applicable, have all dip switches been set and verified to match system requirements?				
	Verify combustion settings after gas conversion, Carbon Dioxide	____% CO2	High Fire	____% CO2	Low Fire
	Verify combustion settings after gas conversion, Carbon Monoxide	____ppm CO	High Fire	____ppm CO	Low Fire
	What is the "drop" on light off (No more than 1" W.C.)?	____ in w.c.	Dynamic		
4) Venting	Has the boiler been vented with 3" PVC, CPVC, Polypropylene, or (AL294C) Stainless for Cat IV boilers?				
	Ensure no ABS or PVC Cellular core has been used				
	Is the vent sloped upward toward the terminal at a rate of ¼" per ft. or 2% grade?				
	Have all intake and exhaust joints been properly sealed and tested?				
	Are all vent runs properly supported?				
	Have the termination screens been installed?				
	Is the vent termination a min of 12" above grade or the highest anticipated snow level?				
	Is the total developed vent length including elbows within the stated max vent length restriction?				
5) Condensate piping / tubing	Is the condensate line piped with the approved materials listed in this manual?				
	Does the condensate line have an air inlet at the top/ beginning of the drain? Refer to Install the Condensate Drain, this manual.				
	Has the condensate been piped over to a drain, and checked to be free flowing?				
	If necessary, has a condensate pump and /or a neutralizer been installed?				
FINAL	**SIGNED BY TECHNICIAN**	**DATE**			

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!

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 assure 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.				
Vent	Check condition of all vent pipes and joints. Ensure all vent piping is properly supported. Check for obstructions 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 heating, water heating, safeties)				
Temperatures (Indirect)	Verify boiler settings or Anti-Scald Valve settings				
Temperatures (Boiler)	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	Check to see that the circuit breaker is clearly labeled. Exercise circuit breaker.				
Switch and Plug	Verify ON/OFF switch and convenience plug are both functional				
CONDENSATE					
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 14" W.C.)				
Pressure Drop	Measure drop in pressure on light off (no more than 1" W.C.)				
Check gas pipe for leaks	Check 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 ECO. Replace if corroded.				
CH LOOPS					
	It is recommended to flush the CH heat exchangers annually if water hardness exceeds 12 grains per gallon (considered extremely hard water). If water hardness falls below 12 grains per gallon it is recommended to flush the heat exchanger every three to five years.				
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 41 - *Continue annual maintenance beyond the 4th year as required.

MAINTENANCE NOTES

CUSTOMER INSTALLATION RECORD FORM

The following form should be completed by the installer 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:	
Installation Address:	
Date of Installation:	
Installer's Code/Name:	
Product Serial Number(s):	
Combustion Setting at Time of Installation:	
Comments:	
Installer's Phone Number:	
Signed by Installer:	
Signed by Customer:	

IMPORTANT NOTES:

Customer: Please only sign after the installer has reviewed the installation, safety, proper operation and maintenance of the system. In the case that the system has any problems, please call the installer. If you are unable to make contact, please contact your HTP Sales Representative.

Distributor/Dealer: Please insert contact details.