



Installation and Operation
Instructions for

THE FT SERIES

Floor Standing, Modulating
Gas, Condensing, Heating Only Boiler

Model FTHF199N
199,000 BTU/h



- Natural Gas (NG) - Factory Configuration
- Propane Gas (LP) - Field-Convertible

FOR YOUR SAFETY: This product must be installed and serviced by a professional service technician, qualified in hot water boiler and heater installation and maintenance. Improper installation and/or operation could create carbon monoxide gas in flue gases which could cause serious injury, property damage, or death. Improper installation and/or operation will void the warranty.

⚠ 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 or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

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

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

⚠ AVERTISSEMENT

Assurez-vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort.

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

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne pas tenter d'allumer d'appareils.
- Ne touchez à aucun interrupteur. Ne pas vous servir des téléphones dans le bâtiment où vous vous trouvez.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur de gaz, appelez le service des incendies.

L'installation et l'entretien doivent être assurés par un installateur ou un service d'entretien qualifié ou par le fournisseur de gaz.

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SECTION 1 Introduction

1.1 About this Installation Manual

For details on Gas Connections/ Combustion Setup (Pages 33-42)

This manual provides the information necessary for the installation, operation, and maintenance of the FT Series Floor Standing, Heating Only Boiler.

All application and installation procedures must be read and reviewed completely before proceeding with the installation. Consult the factory, or your local factory representative, with any problems or questions regarding this equipment. Experience has shown that most operating problems are caused by improper installation.

For details on Combustion Air and Venting, (Pages 14-32)

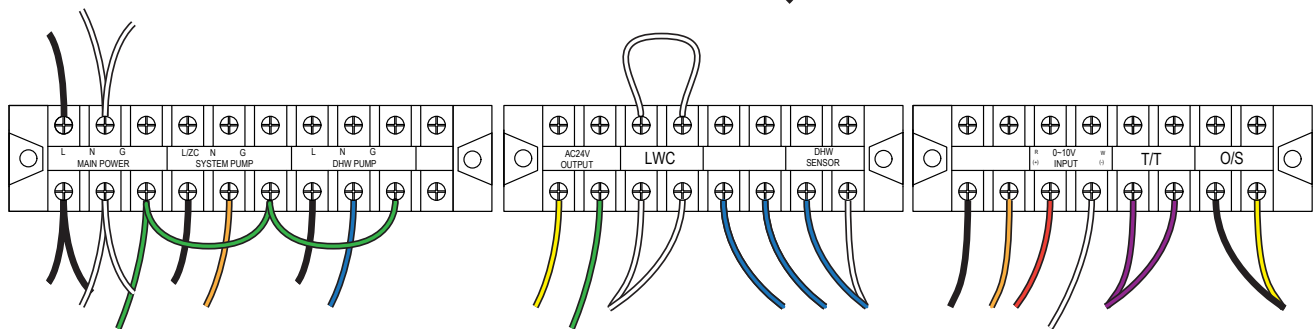
For details on Plumbing for Central Heat, (Pages 43-50)

All installations must be made in accordance with
 1) American National Standard Z223.1/ NFPA54-Latest Edition "National Fuel Gas Code" or
 2) CSA B149.1 "Natural Gas and Propane Installation Code" and with the requirement of the local utility or other authorities having jurisdiction. Such applicable requirements take precedence over the general instructions contained herein.

All electrical wiring is to be done in accordance with the local codes, or in the absence of local codes, with: 1) The National Electrical Code ANSI/NFPA No. 70-latest Edition, or 2) CSA STD. C22.1 "Canadian Electrical Code - Part 1". This appliance must be electrically grounded in accordance with these codes.





For details on Electrical Connections, (Pages 44-49 and 52-56)





For details on Plumbing for Condensate, (Page 51)



***Note:** Do NOT connect 24 V to the T/T or DHW Sensor terminals. Only connect a dry contact closure to these terminals.

1.2 Included in the Box

Item	Description	Qty
Floor Standing Heating Only Boiler FTHF 199, Adjustable boiler leveling feet (Installed)		1
Silicone tubing for air relief on condensate trap and condensate hose		1
O-Ring and Gasket Kit		1
30 psi relief valve, air vent and brass adaptor with 3/4" plug. Part of (accessory box)		1

Item	Description	Qty
Installation Instructions and User's Manual		1
3" Mesh Screens		1
Outdoor sensor		1
Propane Conversion Orifice		1

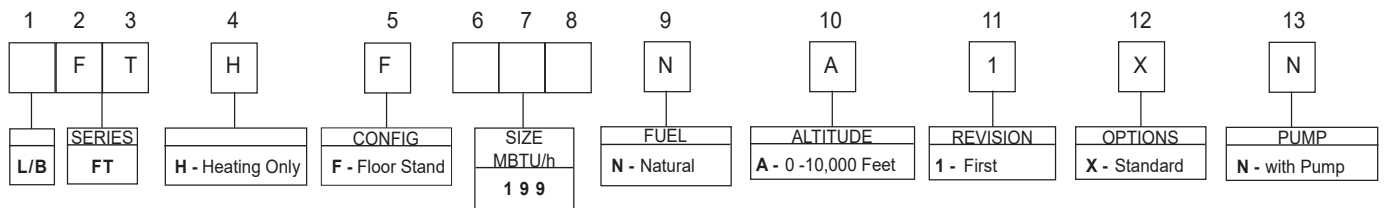
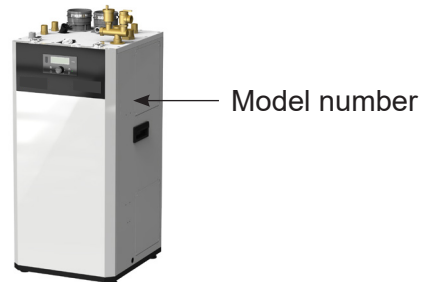
Accessory Box: Boiler 3/4" relief valve (30 psi), combination "brass adaptor" fitting, 3/4" plug for "brass adaptor" fitting, manual air vent.

Auto Fill Valve and Backflow Preventer Valves are NOT included (Field Supplied).

SECTION 2 Product Characteristics

2.1 Model Nomenclature (model number)

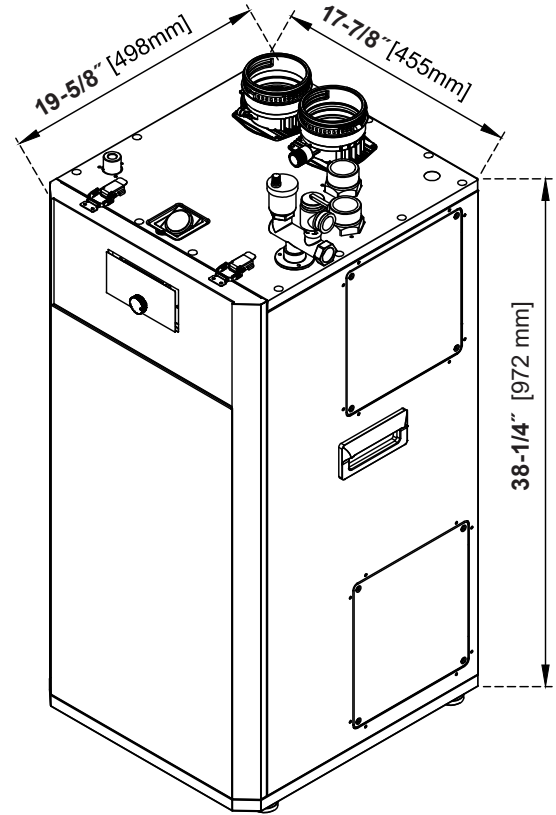
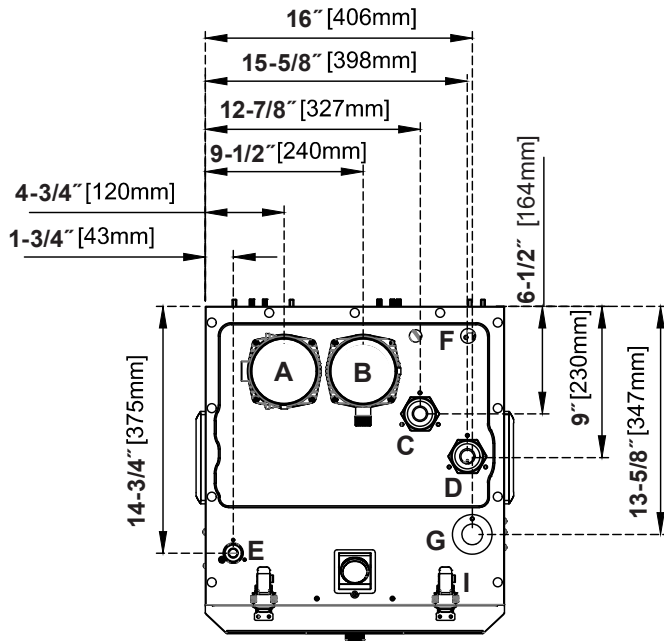
The Model Nomenclature is shown on your Rating Plate and consists of a series of letters and numbers (**Nomenclature**) that further identifies the characteristics of your FT Heating Only Boiler.



2.2 Specifications, 199

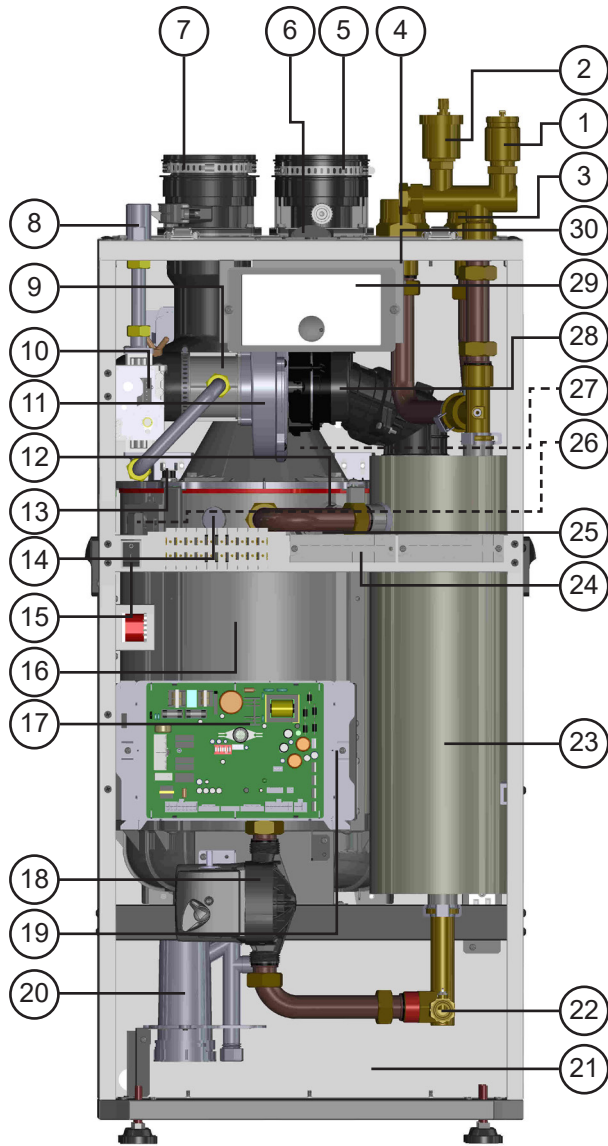
Model Name		FTHF199N			
Gas Input Rate	MAX	199,000 Btu/h			
	MIN	19,900 Btu/h			
Installation		Indoor / Floor stand type			
Flue System		Sealed Combustion Direct / Single Vent / Concentric Vent			
Vent Run		2"(50ft), 3"(100ft) Schedule 40 CPVC, PP, PVC, Stainless Steel, PP Flex			
Orifice Size	NG	0.326" (8.3 mm)			
	LP	0.250" (6.35 mm)			
Gas Supply Pressure	NG	3.5" WC to 10.5" WC			
	LP	8.0" WC to 13" WC			
Manifold	Gas type	NG		LP	
	Vent size	2" VENT	3" VENT	2" VENT	3" VENT
	Max Fire	-0.129"WC	-0.314"WC	-0.169"WC	-0.173"WC
	Min Fire	-0.015"WC	-0.015"WC	-0.015"WC	-0.015"WC
Power Supply	Main Supply	120V 60Hz / 4A			
	Maximum Power Consumption	160W			
Ignition System		Direct Electronic Ignition / Automatic Flame Sensing			
Burner System		Single Orifice Premixed Fuel Modulation			
Gas Valve System		Combination modulating (Current proportional)			
Minimum Flow Rate		0.5 GPM			
Dimensions		W 17-7/8" - H 38-1/4" - D 19-5/8"			
Shipping Weight		130 lbs (59 kg)			
Low Loss Header Capacity		2 Gallons			
Main Controller / Control Panel		NGTB-900CP / P-950EH			
Central Heat Water Pressure, CH		Min 15 ~ Max 30 PSI			
Connection Sizes	Space Heating Supply / Return	1-1/2" NPT			
	Gas Inlet	3/4" NPT			
Materials	Casing	Cold Rolled Carbon Steel			
	Heat Exchanger	Primary Heat Exchanger : Stainless Steel Sub Heat Exchanger : Stainless Steel			
Safety Devices		Optical Flame Sensor, Overheat Cut Off Device, Gas Valve Operation Detector, Exhaust Temperature High Limit Switch, Water Temperature High Limit Switch, Low Water Cut Off, Air Pressure Sensor			

2.3 Dimensions



	Description	Diameter
A	Air Intake Collar	3"
B	Vent Pipe Collar	3"
C	Boiler Supply	1-1/2" NPT
D	Boiler Return	1-1/2" NPT
E	Gas Inlet	3/4" NPT
F	Condensate Line	1/2" (no NPT)
G	Pressure Relief Valve & Air Vent	1" NPT

2.4 Names of Components

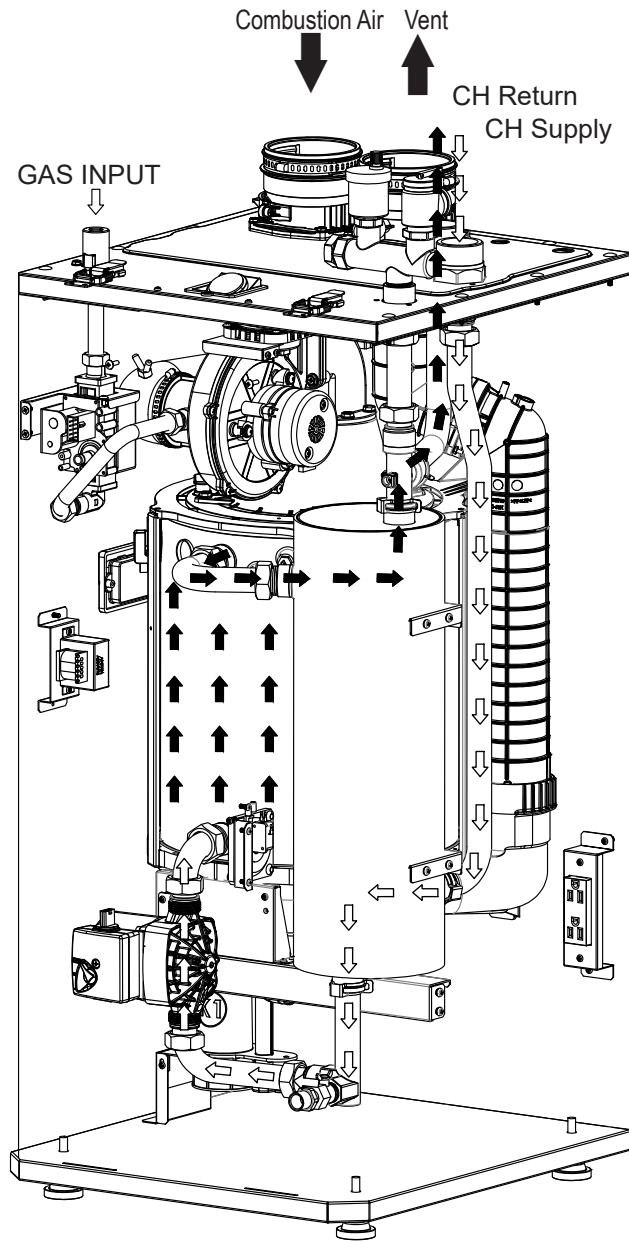


#	Name of Component
1	Pressure Relief Valve
2	Air Vent (air eliminator)
3	Boiler Return Connection
4	Boiler Supply Connection
5	Vent Pipe Collar
6	Boiler Pressure Gauge
7	Air Intake Collar
8	Gas Inlet Adapter
9	Air/ Gas Venturi
10	Gas Valve
11	BLDC Fan (Blower)
12	Low Water Cut Off
13	Burner High Limit Switch
14	Flame Detecting Sensor
15	Manual Power Switch (ON / OFF)
16	Heat Exchanger
17	Main PCB
18	Boiler Pump
19	Blocked Condensate Switch
20	Condensate Trap
21	Condensate neutralizer and Drain pump (optional equipment)
22	Drain Valve
23	Low Loss Header
24	Terminal Block
25	Overheat Temperature Sensor
26	Sight Glass
27	Igniter
28	Exhaust Pipe
29	Control Panel and Display
30	Air Pressure Sensor

2.5 Product Flow Paths and Characteristics

2.5.1 Central Heating flow. Boiler Heating Mode.

Water in the heating system flows through the low loss header (LLH); boiler pump heats water in the boiler and is circulated through LLH. System pump or individual zone pumps are required to pull heated water from CH supply connection and return water to CH return connection.



Central Heating Mode

SECTION 3 Safety Regulations

3.1 Safety Symbols

WARNING

To avoid product damage, personal injury, or even possible death, carefully read, understand, and follow all the instructions in the Installation and Operation manual before installation, operation and service the Boiler.

Manufacturer cannot anticipate every circumstance that might involve a potential hazard. Therefore, all possible incidents are not included in our warnings. Proper installation, operation, and service are your responsibility. You must make sure that the operation and settings of the Boiler are safe for you and for others.

This manual provides Safety Symbols. When the user fails to adhere to the following requirement, it may cause death, serious injury, and substantial property damage.

For safety symbols, 'DANGER', 'WARNING', 'CAUTION' are indicated and the definitions for these terms are as follow:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations.

WARNING

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

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices and hazards involving only property damage.

WARNING

Cancer and Reproductive Harm.
www.P65WARNINGS.CA.GOV.

as required by the state of California Proposition 65.

WARNING

FOR YOUR SAFETY READ BEFORE OPERATING

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

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

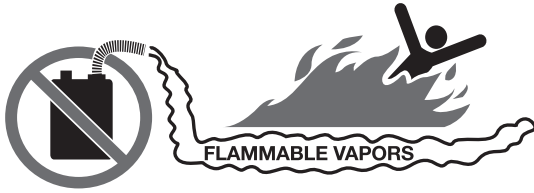
WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
 - Do not touch any electric switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
 - D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

This appliance must be installed in accordance with local codes if any; if not, follow ANSI Z224.1/NFPA 54 or CAN/CSA B149.1, Natural Gas and Propane Installation Code, as applicable.

- This appliance is certified for use at altitudes up to 10,000 feet (3,044 m) in accordance to the latest CSA/CGA 2.17-M91 Gas-Fired Appliances for Use at High Altitudes.

3.2 Safety Precautions and Proper Use



⚠ DANGER

- Vapors from flammable liquids will explode and catch on fire. These will cause death or severe burns.

Do not use or store flammable products such as gasoline, solvents or adhesives in the same room or area near the appliance.

Keep flammable products

- Far away from boiler
- In approved containers
- Tightly closed
- Out of children's reach

Vapors

- Cannot be seen
- are heavier than air
- spread on the floor
- Can spread from other rooms to the main burner by air currents

Do not install the appliance where flammable products will be stored.

Read and follow boiler warnings and instructions thoroughly. If owner's manual is missing, contact the retailer or manufacturer.

- This boiler must be installed by a qualified plumber, a licensed gas fitter, and/or a professional service technician. Improper installation and/or operation will cause a potentially hazardous situation, such as serious injury or death. Also, it will void the warranty.
 - The National Fuel Gas Code NFPA 54 / ANSI Z224.1
 - National Electric Code ANSI/NEPA 70
 - All applicable local, state, national and provincial codes, regulations and laws.
- Proper care is your responsibility. Carefully read and understand the Operating Information in this manual before operating the Boiler.
- Be aware of the location of the gas shut-off valve and operation method. Close the gas shut-off valve immediately if the appliance is subjected to fire, overheating, flood, physical damage, or any other damaging condition that might affect the operation

of the unit. Boiler must be checked by a qualified technician before resuming operation.

- DO NOT use this Boiler if any part has been under water. Immediately call a qualified technician for inspecting the Boiler and replacing any part of the control system and gas control which have been under water.
- Do not power up the unit until the gas and water supply valves are fully opened. Make sure that the fresh air intake port and exhaust gas port are opened and functional.
- DO NOT attempt to install, repair, or service this Boiler by yourself. Do not change any part of the Boiler. Contact a qualified technician if the Boiler needs repair or maintenance. Ask your gas supplier for a list of qualified service providers.
- DO NOT use spray paint, hair spray, or any other flammable spray near Boiler or near the exterior fresh air inlet port. DO NOT place any items in or around the exterior exhaust gas outlet port and/or fresh air inlet port. These could restrict or block the flow in or out of the vent system.
- "Caution: While repairing control, all wires are labeled. You must connect the wires in accordance with the instruction. Wiring errors can cause improper and dangerous operation.
- "Verify proper operation after servicing operation"
- This consists of the gas ignition system components which are protected from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, condensate trap, control replacement, etc.).
- After installing the heater, safety devices must be tested.
- This boiler is equipped with a blocked vent shutoff system. If the error code '44' occurs, follow the instructions below.
 - First, turn off the manual gas valve.
 - Make sure that there is no foreign object in the vent passage or rodent screen.
 - If you do not find any problem, do the following.
 - Turn off the error state by pressing the power button of control panel.
 - If the error occurs repeatedly, call your service technician or gas supplier.

Before Operation

1. Check the Gas Type (NG/LP) when using or moving the unit for the first time. Check if gas type matches with the gas type of the boiler. Check whether the gas type which is supplied is NG (Natural Gas) or LP (Propane) and also check the boiler gas type. The gas type is indicated on the rating plate on side of the Boiler.
2. Check the Power (120V 60Hz). Check that the appliance is connected properly.
3. Check the Cold Water Inlet valve. Please keep the appliance water inlet valve open at all times. The appliance will not ignite when insufficient water or no water is in the heating pipes. (valve: always open position)
4. Check the manual gas shut-off valve on top of the FT boiler gas connection. Make sure this manual gas shut-off valve is opened for operation.
5. Check the area around the appliance and remove any combustible or flammable materials. Remove laundry or any other items that are on or near the boiler or vent pipe.

When in Operation



1. Caution for gas leak
Frequently check for a gas leak at the gas connection portion with soapy water.

Steps to take if you have a gas leak.

1. Shut down the boiler as soon as gas fumes are detected.
2. Close the manual gas shut-off valve.
3. Open windows for ventilation.
4. Do not create any sparks! Leave the property immediately and call your local utility or qualified service technician for immediate repair.

WARNING

Do not use the appliance for any other purpose than for heating and hot water.
Do not store combustibles or flammable material such as gasoline near the appliance.
Do not store other items on or near this boiler.
Do not store combustible (flammable) materials such as papers.
Do not hang clothes on the vent pipe. This may start a fire.

2. Caution for Ventilation

Make sure that there is sufficient inflow and outflow of air ventilation while using the unit.

If the ventilation is improper, combustion quality may deteriorate inside the appliance and cause shortened life of the appliance.

3. Burn Warning

Be careful not to burn yourself on the flue or pipes. They become extremely hot during operation.

CAUTION

Scalding Risk: Manufacturer strongly recommends the use of an anti-scald mixing valve at domestic hot water outlet (indirect tank location) to reduce potential for scalding. Check with local codes.

Carbon monoxide poisoning

If vent pipe fumes enter the room, it could cause poisoning by carbon monoxide gas. Check that the vent pipes are properly connected. Open windows for ventilation. Call a qualified service technician for immediate repair.

Gas leakage test.

Gas supply line must be inspected regularly.

Do not shut off the Boiler.

When you leave home for a long time, do not shut off Boiler. The Boiler has a freeze protection function.

Do not wipe the appliance or control panel with wet cloth. Electric shock may occur, or internal parts may fail due to the exposure to moisture.

Do not disassemble the Boiler.

If repair is required, call your local qualified technician.

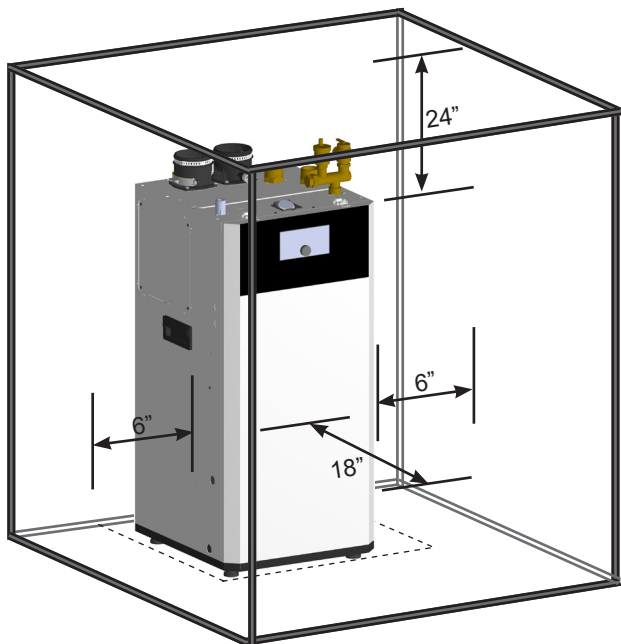
CAUTION

After repair of gas pipeline or gas regulator replacement, call a qualified contractor for inspection before starting it up.

SECTION 4 Installation

4.1 Location and Clearances

The FT floor boiler must be installed on a level surface of sufficient strength and follow the clearances listed in Table 1. Leveling feet are provided to ensure a plumb installation.



Appliance Surface	Clearance from Combustibles and Non-combustible Surfaces
Back	1 in (2.5 cm)
Left Side	1 in (2.5 cm)
Right Side	1 in (2.5 cm)
Front	1 in (2.5 cm)
Top (Alcove Install)	9 in (22.86 cm)
Top (Closet Install)*	22 in (56 cm)
Vent : Concentric, Direct	0 in (0 cm)
Vent : Category IV	3 in (76 cm)
Suggested Serviceability Clearances	
Front	18 in (46 cm)
Left Side	6 in (15 cm)
Right Side	6 in (15 cm)
Top	24 in (61 cm)

Table 1. Minimum Clearances to Combustibles and for Service.

⚠ WARNING

- Installations must comply with
 - All the local, state, provincial, and national codes, laws, regulations and ordinances.
 - National Fuel Gas Code, ANSI Z223.1 – The latest version.
 - National Electrical Code.
 - A National Standard of Canada CAN/CSA-B149.1
- Check before placing the boiler
 - Always check the connected components which are near to the boiler. The components are below.
- Water piping position / Venting adapter / Gas supply piping / Electrical power / Condensate drain hose.
 - Inspect area around boiler. Remove any combustible materials, gasoline and other flammable liquids. Failure to keep boiler area clear and free of combustible materials, gasoline and other flammable liquids and vapors can result in severe personal injury, death or substantial property damage.
 - The boiler which has gas control system components must be protected from any possible danger during operation and service.
 - If the new boiler replaces an existing appliance, check and correct system problems, for example:
 - Do not install if: System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits.
- Provide clearances
 - If the boiler was installed in a narrow space or corner, please ensure that there is sufficient space for service and maintenance access. For regular maintenance, gas and water lines must be accessible.
- This boiler must be installed upright in the vertical position as described in this manual.

⚠ WARNING

- CLEARANCES FOR SERVICE ACCESS
 - If you do not provide the minimum clearances shown, it might not be possible to service the boiler without removing it from the space.
 - Space must be provided with combustion / ventilation air openings correctly sized for all other appliances located in the same space as the boiler. The boiler cover must be securely fastened to prevent it from drawing air from the boiler room. This is particularly important if the boiler is in a room with other appliances. Failure to comply with the above warnings could result in substantial property damage, severe personal injury, or death.

4.2 Flooring & Leveling

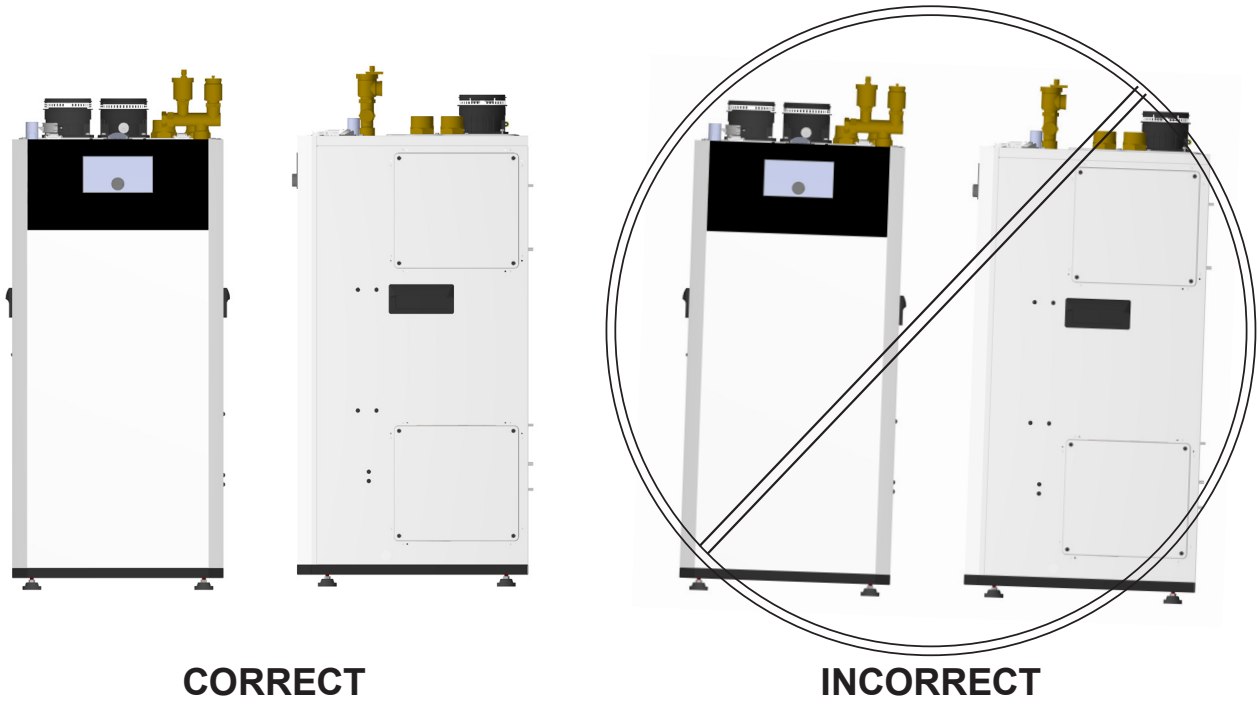
⚠ WARNING

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

This boiler is approved for installation on combustible flooring, but must never be installed on carpeting. Installing this boiler on carpeting could result in fire, property damage, severe personal injury, or death.

⚠ CAUTION

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



Boiler leveling feet are factory installed for your convenience.

* If small adjustments are required, tilt the boiler either to the left or right side and adjust the proper leveling feet.

Do NOT tip the boiler backwards or forwards as the protruding base on the front may interfere with the floor and may deform.

Note: When moving the boiler, use hand holds in left and right side panels to pick the boiler. Do not slide boiler along the floor on its boiler feet, as this may damage the feet.

4.3 Combustion Air

FT boilers must have provisions for combustion and ventilation air in accordance with the applicable requirements for Combustion Air Supply and Ventilation in the National Fuel Gas Code, ANSI Z223.1; or in Canada, the Natural Gas and Propane Installation Code, CSA B149.1. All applicable provisions of local building codes must also be adhered to.

A FT unit can take combustion air from the space in which it is installed, or the combustion air can be ducted directly to the unit. Ventilation air must be provided in either case.

4.3.1 Combustion Air from Room

In the United States, the most common requirements specify that the space shall communicate with the outdoors in accordance with method 1 or 2, which follow. Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect.

Method 1: Two permanent openings, one commencing within 12" (300mm) of the top and one commencing within 12" (300mm) of the bottom, of the enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors. When directly communicating with the outdoors, or when communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4000 Btu/hr (550 square mm/kW) of total input rating of all equipment in the enclosure. When communicating to the outdoors through horizontal ducts, each opening shall have a minimum free area of not less than 1 square inch per 2000 Btu/hr (1100 square mm/kW) of total input rating of all equipment in the enclosure.

Method 2: One permanent opening, commencing within 12" (300mm) of the top of the enclosure, shall be permitted. The opening shall directly communicate with the outdoors or shall communicate through a

vertical or horizontal duct to the outdoors or spaces that directly communicate with the outdoors and shall have a minimum free area of 1 square inch per 3000 Btu/hr (734 square mm/kW) of the total input rating of all equipment located in the enclosure. This opening must not be less than the sum of the areas of all vent connectors in the confined space.

Other methods of introducing combustion and ventilation air are acceptable, providing they conform to the requirements in the applicable codes listed above.

In Canada, consult local building and safety codes or, in absence of such requirements, follow CAN/CGA B149.1

4.3.2 Ducted Combustion Air

The combustion air can be taken through the wall, or through the roof. When taken from the wall, it must be taken from out-of-doors by means of the horizontal wall terminal. When taken from the roof, a field-supplied rain cap or an elbow arrangement must be used to prevent entry of rain water.

Use ABS, PVC, CPVC, polypropylene, or galvanized pipe for the combustion air intake. Route the intake to the boiler as directly as possible. Seal all joints. Provide adequate hangers at every 4 foot interval and at every elbow for proper support. The unit must not support the weight of the combustion air intake pipe. Maximum linear pipe length allowed is shown in Table 5. (See page 21). Subtract the required deduction in length for each installed elbow as per Table 5.

The connection for the intake air pipe is at the top of the unit.

In addition to air needed for combustion, air shall also be supplied for ventilation, including air required for comfort and proper working conditions for personnel.

COMBUSTION AIR INSTALLATION STANDARDS

MATERIAL	UNITED STATES	CANADA
ABS	ANSI/ASTM D1527	Air pipe material must be chosen CPVC, sch 40, ANSI/ASTM, Polypropylene based upon the intended application of the boiler.
PVC, sch 40	ANSI/ASTM D1785 or D2665	
CPVC, sch 40	ANSI/ASTM F441	
Polypropylene	UL1738, ULC S636.	
Single wall galv. steel	26 gauge	

Table 2. Required Combustion Air Pipe Material.

⚠ NOTICE

The instructions for the installation of the venting system shall specify that the horizontal portions of the venting system shall be supported to prevent sagging; the methods of and intervals for support shall be specified. These instructions shall also specify that the venting system:

Category I, II and IV boilers must be installed so that horizontal sections have an upward slope away from the boiler of at least ¼ inch per foot (21 mm/m) to prevent accumulation of condensate; and For Category II and IV boilers, where necessary, have means provided for drainage of condensate.

⚠ NOTICE

For long, trouble free operation, it is critical that the FT unit has always access to clean combustion air, either drawn from an inside space (per section 4.3.1) or external (per section 4.3.2).

- Do NOT allow contaminated indoor air (either by internal dust, sheet rock, PVC or CPVC pipe debris dust or similar contamination) to be drawn in through the air intake connection. If the unit must operate under job site conditions, always ensure availability of fresh air and protect the unit accordingly.
- For ducted combustion air from the outdoors, follow the guidelines provided in Sections 4.6 through 4.8 and make sure that clean air is always available for combustion.
- During assembly of the air intake system, make sure that any PVC or CPVC pipe debris due to cutting pipe is fully removed and all connecting surfaces are smooth and free of contamination.
- Visually inspect air intake piping for interior debris or shavings. It may be necessary to wash out the air intake piping.

⚠ CAUTION

When an existing Cat I appliance is removed or replaced, the original venting system may no longer be sized to properly vent the attached appliances. Under no circumstances should an improperly sized vent be used. An improperly sized vent may cause operational and safety problems, and could result in serious injury, death, or property damage.

⚠ AVIS

Les instructions d'installation du système d'évacuation doivent préciser que les sections horizontales doivent être supportées pour prévenir le fléchissement. Les méthodes et les intervalles de support doivent être spécifiés. Les instructions doivent aussi indiquer les renseignements suivants:

les chaudières de catégories I, II et IV doivent présenter des tronçons horizontaux dont la pente montante est d'au moins ¼ po par pied (21 mm/m) entre la chaudière et l'évent; les chaudières de catégories II et IV doivent être installées de façon à empêcher l'accumulation de condensat; et si nécessaire, les chaudières de catégories II et IV doivent être pourvues de dispositifs d'évacuation du condensat.

⚠ CAUTION

- The FT is standard as a Natural Gas Boiler and must be converted if propane is the desired gas, using the furnished LP conversion kit.
- Adequate drainage
 - The appliance should be installed not to damage the adjacent area. If such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not block combustion air flow.
- Connecting the Water Supply
 - To conserve water and energy, insulate all water piping—especially the hot and recirculation water lines. Never cover the drain or pressure relief valve. Having a backflow preventer in the cold water supply line will prevent thermal expansion backflow. Contact the water supplier or local plumbing inspector for information about how to control this situation.
- If overheating occurs or the gas supply fails to shut off, turn off the manual gas valve.
- This installation must conform with below section
 - “Air for Combustion and Ventilation” of the National Fuel Gas Code, ANSI Z224.1/NFPA 54, or Sections 8.2, 8.3 or 8.4 of Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

4.4 Venting (Exhaust)

NOTICE

DO NOT COMMON VENT FT UNITS. FT units are never permitted to share a vent with Category I appliances.

AVIS

NE PAS ÉVENT COMMUNE FT UNITÉS. FT unités ne sont jamais autorisés à partager un évent Catégorie I avec les appareils.

The flue temperature of the FT changes dramatically with changes in operating water temperature. Therefore, it is necessary to assess the application of the boiler to determine the required certified vent class. If the FT is installed in an application where the ambient temperature is elevated, and/or installed in a closet/alcove, CPVC, polypropylene, or stainless steel material is required. If the system temperatures are unknown at the time of installation, stainless, polypropylene or CPVC material is recommended.

The FT is a Category IV appliance and may be installed with PVC, CPVC or polypropylene (PP) and PP Flex that complies with ULC-S636, ANSI/ASTM D1785 F441 (see Table 3) or a stainless steel venting system that complies with UL 1738 Standard and ULC S636.

WARNING

Failure to use the appropriate vent material, installation techniques, glues/sealants could lead to vent failure causing property damage, personal injury or death.

WARNING

All venting must be installed according to this manual and any other applicable local codes, including but not limited to, ANSI Z224.1/NFPA 54, CAN/CSA B149.1 and ULC-S636. Failure to follow this manual and applicable codes may lead to property damage, severe injury, or death.

WARNING

Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) used in non-metallic venting systems is prohibited.

Non-metallic vent pipe (PVC, CPVC, (PP), PP Flex or other) shall NOT be insulated or covered. Insulating or covering non-metallic venting may cause overheating which diminishes the integrity of the pipe.

INSTALLATIONS IN CANADA require the use of venting material certified to ULCS636. All Gas vents connected to the FT, plastic, stainless steel or otherwise must be certified to this ULC standard. Appropriate selection of vent material is very important for proper performance and safe operation of the FT.

The flue temperature of the FT changes dramatically with changes in operating water temperature. Therefore, it is necessary to assess the application of the boiler to determine the required certified vent class. If the FT is installed in an application where the outlet water temperature exceeds 145°F, and/or installed in a closet, class IIB or higher vent material is required. If the system temperatures are unknown at the time of installation, class IIB or higher venting material is recommended.

IN CANADA all venting used must meet the following requirements:

1. ULC-S636 certified and marked
2. The first 3 feet of venting must be accessible for visual inspection.
3. All components used in the vent system must be from a certified manufacturer.

VENTING INSTALLATION STANDARDS

MATERIAL	UNITED STATES	CANADA
Stainless Steel	UL 1738	Venting must be ULC-S636 certified for use as venting material. The venting material must be chosen based upon the intended application of the boiler.
PVC, sch 40	ANSI/ASTM D1785	
CPVC, sch 40 Polypropylene (PP), PP Flex	ANSI/ASTM F441 UL1738 or ULC-S636	

Table 3. Required Exhaust Vent Material.

4. Venting system components can only be mixed with alternate manufacturers' certified components when clearly listed in the manufacturers Installation Manual.
5. The venting must be installed according to the vent manufacturers installation instructions.

The unit's vent can terminate through the roof, or through an outside wall.

Vent pipe must pitch upward, toward the vent terminal, not less than 1/4" per foot, so that condensate will run back to the FT to drain. Route vent pipe to the boiler as directly as possible. Seal all joints and provide adequate hangers as required in the venting system manufacturer's Installation Instructions. Horizontal portions of the venting system must be supported to prevent sagging and may not have any low sections that could trap condensate. The unit must not support the weight of the vent pipe.

WARNING

- Failure to vent this Boiler in accordance with these instructions could cause a fire, resulting in severe property damage, personal injury or death.
- Do not interchange vent systems or materials unless it is specified.
- The use of thermal insulation covering pipe and fittings is prohibited.
- Do not apply an electric damper, draft hood or vent damper with this Boiler.
- Do not locate vent termination where exposed to prevailing winds. Moisture and ice may fall on surface around vent termination. To prevent deterioration, surface must be in good repair (sealed, painted, etc.).

4.5 General Location Guideline

1. Vent system installation must be in accordance with Local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z224.1 /NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.
 2. The Boiler is designed to be installed as a Direct Vent (sealed combustion) type. The air for combustion must be supplied directly from the outside to the burner. Also, the flue gases must be vented directly to the outdoors (through wall or roof).
 3. Do not install venting system components on the exterior of 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 vent and air intake terminals. The vent and air intake terminals must be at the same height and their center lines must be spaced apart 12" minimum.
 - The bottom of the vent and air intake terminal must be at least 12" above the normal snow line. In no case should they be less than 12" above grade level.
- Do not install the vent terminal directly over windows or doors.
 - Air intake terminal must not terminate in areas that might contain combustion air contaminants, such as near swimming pools.
 - For sidewall venting, the minimum horizontal distance between any adjacent individual Module (Boiler) vent terminations is twelve (12) inches. It is better to be far more than 12 inches for avoiding frost damage to building surfaces where vent terminations are placed.
 - The minimum horizontal distance between any adjacent individual module (boiler) roof vent end piece is one (1) foot.
- The vent shall not terminate:
- over public walkways:
 - near soffit vents, crawl space vents or other areas where condensate or vapor could create a nuisance or hazard, or cause property damage:
 - where condensate or vapour could cause damage or could be detrimental to the operation of regulators, relief valves or other equipment.

4.6 Locations for Vent Pipe Terminator

	Canadian Installations ¹	U.S. Installations ²	
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	<ul style="list-style-type: none"> 6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW) 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW) 36 in (91 cm) for appliances >100,000 Btuh (30 kW) 	<ul style="list-style-type: none"> 6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW) 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW) 12 in (30 cm) for appliances >50,000 Btuh (15 kW)
C =	Clearance to permanently closed window	See Note 4	See Note 5
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	See Note 4	See Note 5
E =	Clearance to unventilated soffit	See Note 4	See Note 5
F =	Clearance to outside corner	See Note 4	See Note 5
G =	Clearance to inside corner	See Note 4	See Note 5
H =	Clearance to each side of centerline extended above meter / regulator assy	3 ft (91 cm) within a height of 15 ft (4.6 m)	See Note 5
I =	Clearance to service regulator vent outlet	3 ft (91 cm)	See Note 5
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	<ul style="list-style-type: none"> 6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW) 12 in (30cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW) 36 in (91 cm) for appliances ≤ 100,000 Btuh (30 kW) 	<ul style="list-style-type: none"> 6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW) 9 in (23cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW) 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	7 ft (2.13 m) for mechanical draft systems (Category I appliances). Vents for Category II and IV appliances cannot be located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard*
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	See Note 5

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
 ‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

Notes:

- 1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code.
- 2) In accordance with the current ANSI Z223.1/NFPA 54, Natural Fuel Gas Code.
- 3) If locally adopted installation codes specify clearances different than those illustrated, then the most stringent clearance shall prevail.
- 4) For clearances not specified in CAN/CSA-B149, clearance is in accordance with local installation codes and the requirements of the gas supplier.
- 5) For clearances not specified in ANSI Z223.1/ NFPA 54, clearance is in accordance with local installation codes and the requirements of the gas supplier.
- 6) IMPORTANT: Terminal must be placed such that it remains a minimum of 12" above maximum expected snow line. Local codes may have more specific requirements, and must be consulted.

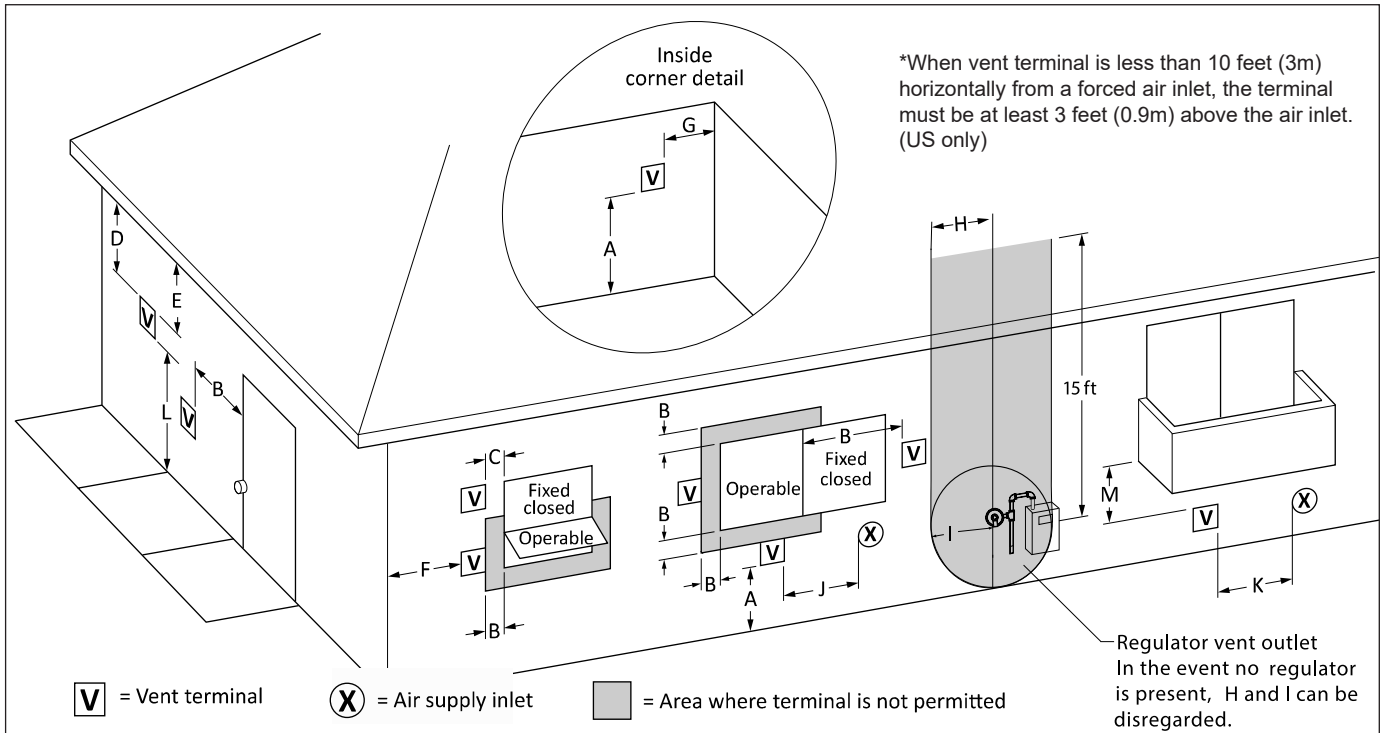


Table 4. Direct Vent Clearances

4.6.1 Venting Requirements in the Commonwealth of Massachusetts

In Massachusetts the following items are required if the side-wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches. From Massachusetts Rules and regulations 248 CMR 5.08

1. Installation of Carbon Monoxide Detectors

At the time of installation of the side wall vented gas fueled appliance, the installing plumber or gasfitter shall observe that a hard-wired carbon monoxide detector with an alarm battery back-up is installed on the floor level where the gas appliance is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard-wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side-wall horizontally vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for installation of hard-wired carbon monoxide detectors.

a. In the event that the side-wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard-wired carbon monoxide with alarm and battery back-up may be installed on the next adjacent floor level.

b. In the event that the requirements of the subdivision 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 be installed.

2. Approved Carbon Monoxide Detectors. Each carbon monoxide detector shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

3. Signage. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print no less than one-half (1/2) inch in size: "GAS VENT DIRECTLY BELOW, KEEP CLEAR OF ALL OBSTRUCTIONS".

4. Inspection The state or local gas inspector of the side-wall horizontally vented gas fueled appliance shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a) 1-4.

4.7 Common Vent Test

NOTE: This section does not describe a method for common venting FT units. It describes what must be done when an existing unit is **removed** from a common vent system.

NOTICE

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any Not Used openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so the appliance will operate continuously.
5. Operate the main burner for 5 minutes then, determine if the cut-draw overflows to the discharge opening. Use the flame of a match or a candle or the smoke of a cigarette, a cigar or a pipe
6. Once it has been determined, according to the method indicated above, that each device connected to the drainage system is placed in the open air in an adequate manner. Install the doors and windows, fans, the registers of chimneys and gas appliances to their original position
7. Any malfunction of the venting system should be corrected so that the installation conforms to the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and (or) the installation codes CAN/CSA-B149.1. If the size of a section of the evacuation system must be changed, the system should be modified to comply with the minimum values of the relevant tables of appendix F of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and (or) the installation codes CAN/CSA-B149.1

NOTICE

DO NOT COMMON VENT FT UNITS. FT units are never permitted to share a vent with Category I appliances.

AVIS

Au moment du retrait d'une chaudière existante, les mesures suivantes doivent être prises pour chaque appareil toujours raccordé au système d'évacuation commun et qui fonctionne alors que d'autres appareils toujours raccordés au système d'évacuation ne fonctionnent pas:

1. Sceller toutes les ouvertures non utilisées du système d'évacuation.
2. Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement, de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.
3. Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés au système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sècheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinière et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.
4. Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.
5. Faire fonctionner le brûleur principal pendant 5 min ensuite, déterminer si le coupe-tirage déborde à l'ouverture de décharge. Utiliser la flamme d'une allumette ou d'une chandelle ou la fumée d'une cigarette, d'un cigare ou d'une pipe.
6. Une fois qu'il a été déterminé, selon la méthode indiquée ci-dessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façon adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.
7. Tout mauvais fonctionnement du système d'évacuation commun devrait être corrigé de façon que l'installation soit conforme au National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) aux codes d'installation CAN/CSA-B149.1. Si la grosseur d'une section du système d'évacuation doit être modifiée, le système devrait être modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) les codes d'installation CAN/CSA-B149.1

AVIS

NE PAS ÉVENT COMMUNE FT UNITÉS. FT unités ne sont jamais autorisés à partager un évent Catégorie I avec les appareils.

4.8 Air Supply and Vent Connections

4.8.1 Vent / Air Pipe Lengths for dual pipe venting systems.

	2" Combustion Air & Vent Pipe			3" Combustion Air & Vent Pipe		
	Min. Combustion Air Pipe	Min. Vent Pipe	Max. Combustion Air & Vent Pipe	Min. Combustion Air Pipe	Min. Vent Pipe	Max. Combustion Air & Vent Pipe
FTHF 199 NG & LP	0 FT* (0 M)	3 FT (1 M)	50 FT (15 M)	0 FT* (0 M)	3 FT (1 M)	100 FT (30 M)
Deductions per 90° Elbow	8 FT (2.4 M)			5 FT (1.5 M)		
Deductions per 45° Elbow	4 FT (1.2 M)			2.5 FT (.75 M)		
Max. # of Total Elbows on Air Intake & Exhaust Vent	4			6		

Table 5. Maximum Vent / Air Pipe Lengths for either 3" or 2" Pipes (PVC schedule 40, CPVC schedule 40, SS, PP)

*Appliance needs to vent outdoors using approved vent caps and following all guidelines as noted in the Installation Manual.

NOTES:

- One must include all elbows on the air intake and exhaust piping in determining the maximum equivalent length of the air intake and exhaust vent piping.
- A total of 4 elbows matches the total number of elbows allowed for 2" venting.

Example: 2" venting system desired.

Air intake piping: Two 90 elbows and 15 ft of straight pipe: $2 \times 8 \text{ ft} + 15 \text{ ft} = 31 \text{ ft}$ (okay)

Exhaust vent piping: Two 90 elbows and 20 ft of straight pipe: $2 \times 8 \text{ ft} + 20 \text{ ft} = 36 \text{ ft}$ (okay)

NOTE: Proper protection against debris in the air intake (through using a downward spout and/or screen) to avoid debris pick-up / falling into the appliance is required.

4.8.2 Direct Venting

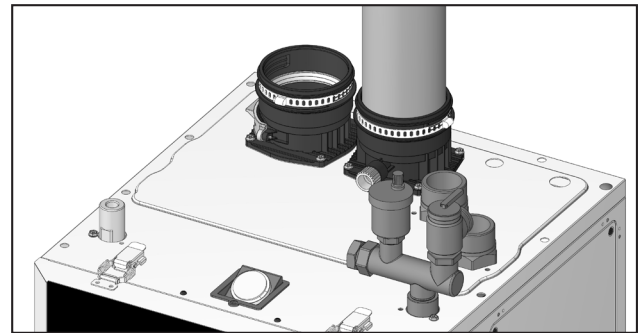
The FT boiler uses 3" or 2" diameter exhaust and 3" or 2" diameter intake air ducts. To ensure the draw of air directly from and exhaust of air directly to the outside of the building, create an airtight seal from the boiler collar to the vent termination.

(For installations in Canada) field-supplied plastic vent piping must comply with CAN/CSA B149.1 (latest edition) and be certified by 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 of the certified vent system must be from a single system manufacturer and must not be intermixed with another system manufacturer's parts.

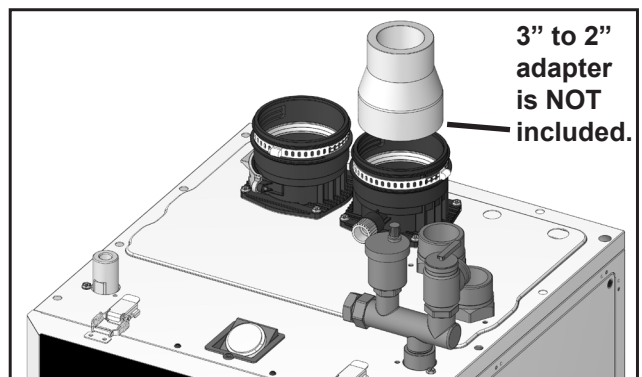
■ Tightening — Boiler Collar (Socket) to Vent Pipe & Inlet Pipe

- Clean and dry your selected PVC, CPVC vent pipe and boiler collar (socket).
- Push the pipe into the collar (socket) until it touches the bottom of the socket fitting.
- For 2" installations, install a field supplied 3" to 2" adaptor. Adaptor must be installed in vertical section of piping only.

3" pipe



2" pipe connected, using an adapter

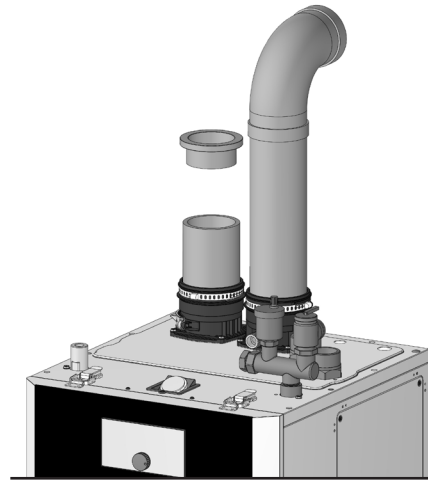


4.8.3 Indoor Combustion Air

Read and follow section 4.3 Guidelines first.

1. Insert the termination end cap into the intake air duct.
2. Provide two openings to allow for circulation of combustion air as specified by ANSI Z224.1/NFPA 54. In Canada refer to CAN/CSA B-149.1

NOTE: The FT needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.



Model	FTHF 199
Maximum Input (BTU/H)	199,000
Indoor make up air is provided, a minimum free area of 1 sq. inch. per 1,000 BTU/H	199 in ² 13 1/4" (W) x 13 1/4" (H)

4.9 Vent / Air Pipe Termination

Vent Air Terminations:

After connecting terminals install vent screens on both the vent and air inlet.

Two 3" vent screens are included with each unit. Additional replacement screens are available for purchase.

2" Vent Screen P/N - FT1508

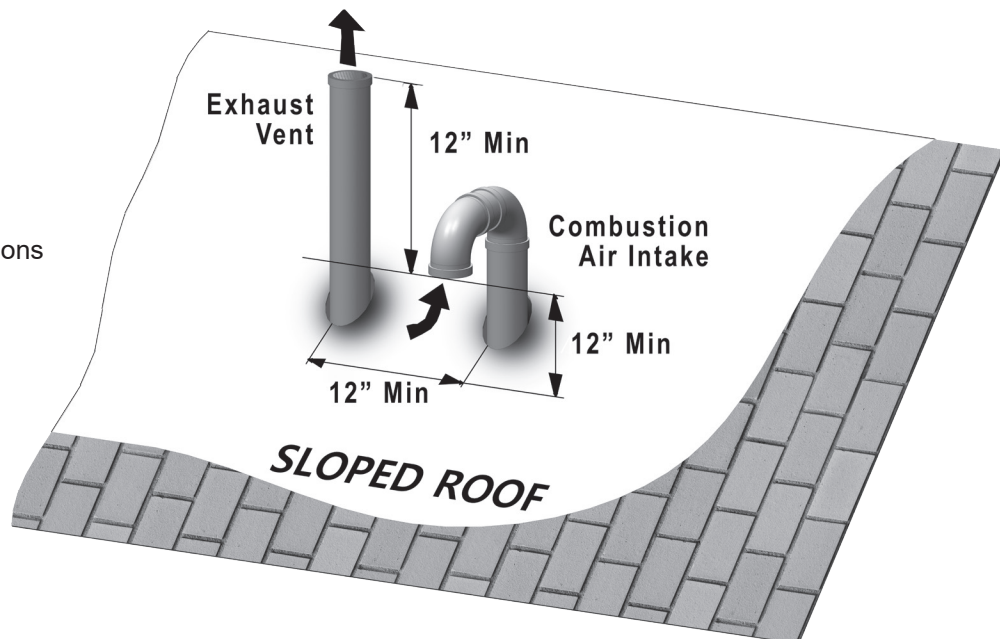
3" Vent Screen P/N - FT1730

Vertical Vent Termination

- Direct Vent - Vertical Terminations with Sloped Roof



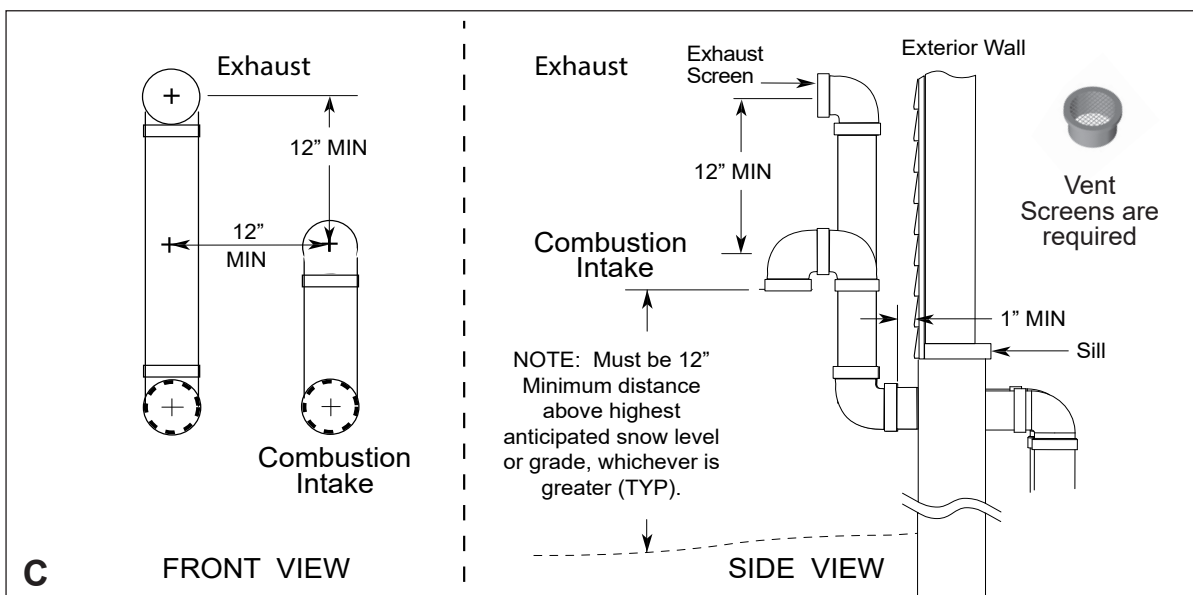
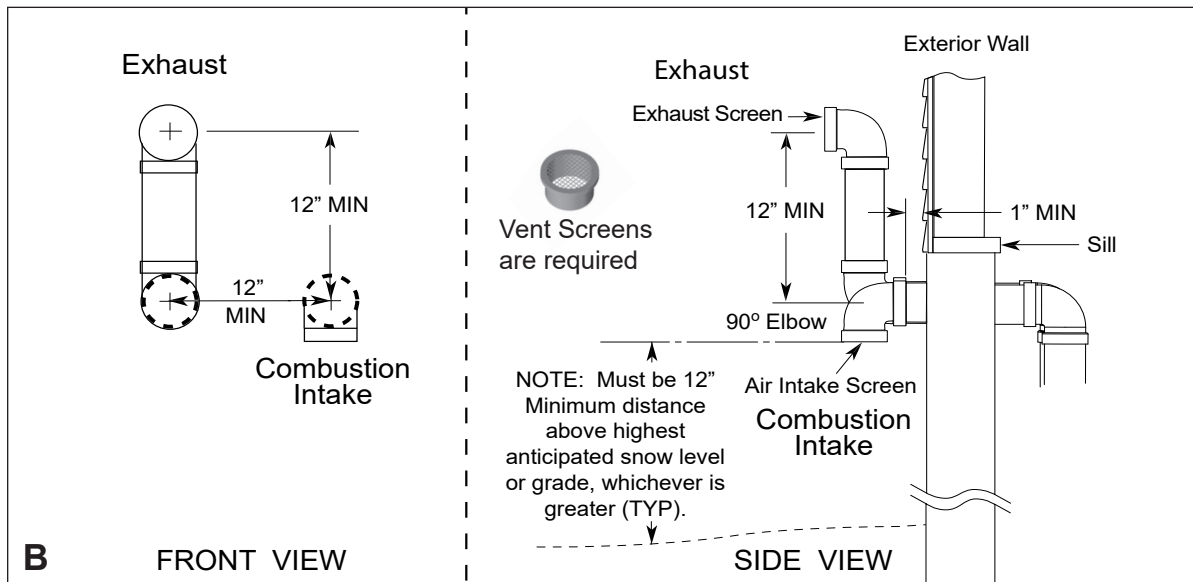
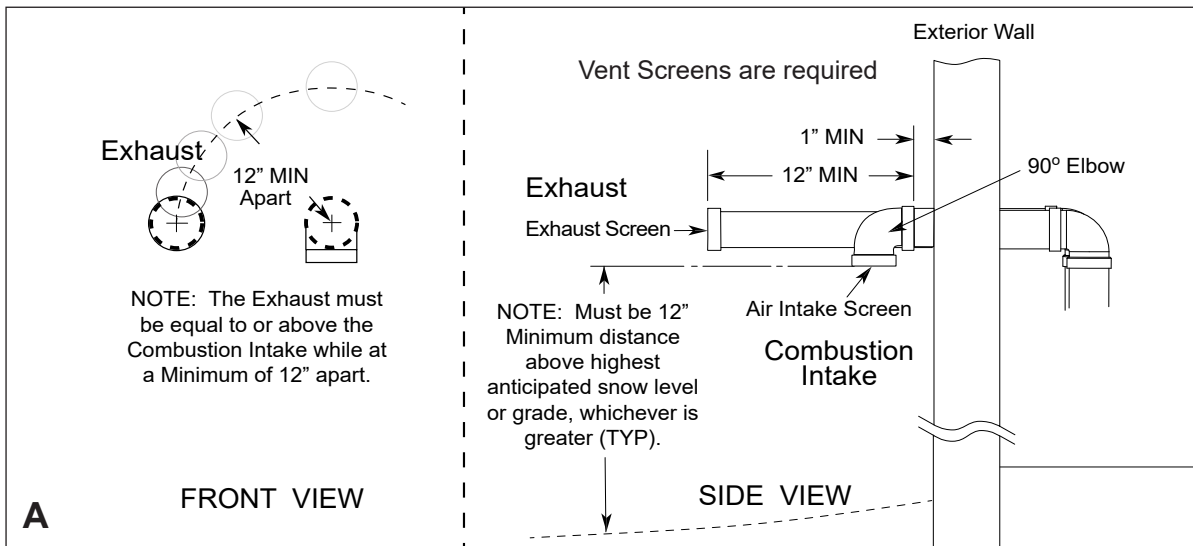
Vent Screens are required



Horizontal Vent Termination

• Direct Vent - Sidewall Termination

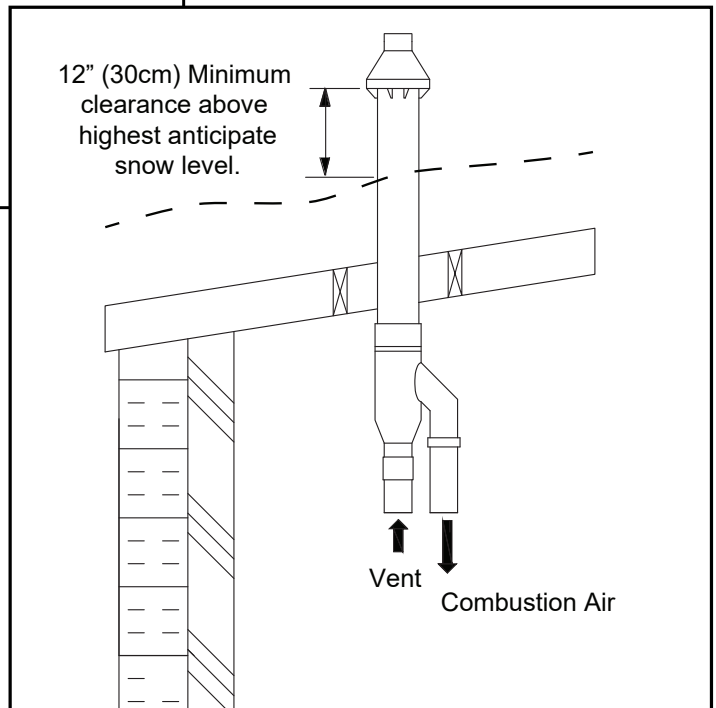
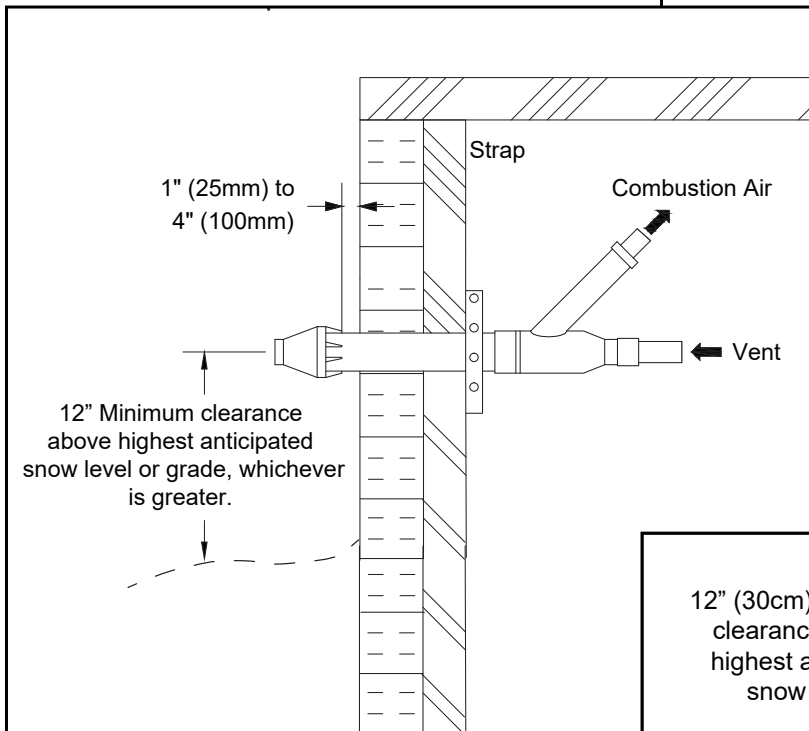
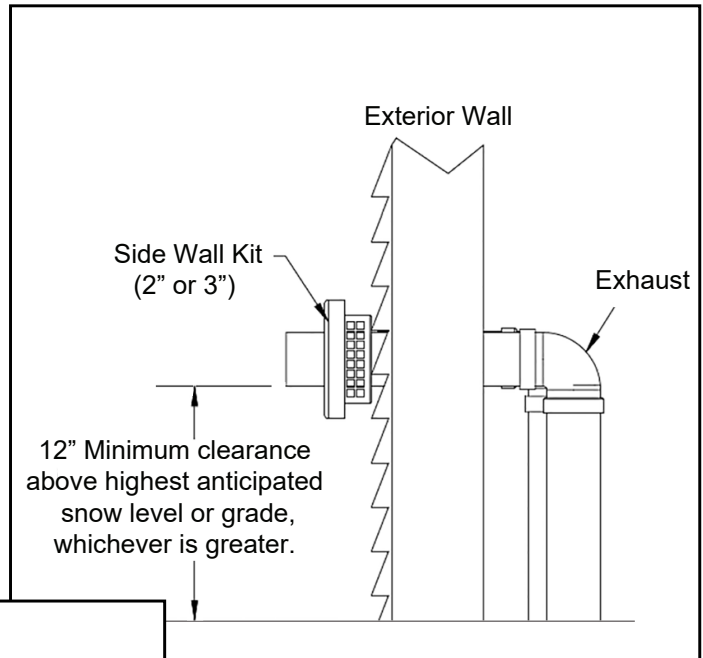
4.9 Vent / Air Pipe Termination (continued)



Concentric Vent Termination

- Direct Vent - Optional Horizontal and Vertical Concentric Vent

NOTE: Concentric Vent Terminations cannot be less than 12" apart in multi-unit installations. Consult local codes and the manufacturer's guidelines for acceptable separation distances.



4.10.1 Concentric Venting Systems

The following concentric venting systems and components are approved for use with the FT floor standing boilers:

Table 6: Approved Heat-Fab SC series 3” x 5” stainless steel concentric venting components.

Heat Fab Part No.	Description	Part Number
	Dual pipe to concentric appliance adaptor	FT3006
SC03E90	3” x 5” 90° concentric elbow	
SC03E45	3” x 5” 45° concentric elbow	
SC03AJ	3” x 5” adjustable length pipe (12” to 18”)	
SCLO3L36	3” x 5” ft length concentric pipe	
SC03VT	3” x 5” vertical termination adaptor	
SC03RC	3” vertical rain cap	
SC03HT	3” x 5” horizontal termination adaptor	
9390TEE	3” Tee termination with screen	
9390	3” mitered termination with screen	
3 SCREEN TERMINATION	3” screen termination	

Table 7: Approved Duravent PolyPro (PP) 3” x 5” concentric venting material and special listed accessories.

Duravent Part Number	Description	Part Number
	PP Offset kit	FT3001
	PP Stub-out kit	FT3002
	PP to Heat-Fab adaptor	FT3003
	Telescopic concentric and 90°elbow kit	FT3004
3PPC-E90	3” x 5” concentric 90°elbow	
3PPC-P1000	3” x 5” concentric pipe 1000mm	
3PPC-P500	3” x 5” concentric pipe 500mm	
3PPC-VCT	3” x 5” concentric vertical termination	
3PPC-HCT	3” x 5” concentric horizontal termination	

Both concentric venting systems are approved for a total linear length of 25 ft and noted special adaptor and up to a maximum of 3 90° concentric elbows with either a horizontal or vertical concentric exhaust/intake termination. The entire venting system must slope back to the boiler to allow drainage of condensate. Please refer to Section 4.6 for approved termination locations for all applications.

Detailed installation instructions must be followed in this manual as outlined in the sections below. Only listed special accessories recorded in this manual are allowed for use in concentric venting applications.

Note: FT part numbers shown in Table 6 and 7 are directly available from your local FT boiler wholesaler or supplier.

4.10.2 Installation of a Complete New Concentric Stainless Steel Venting System.

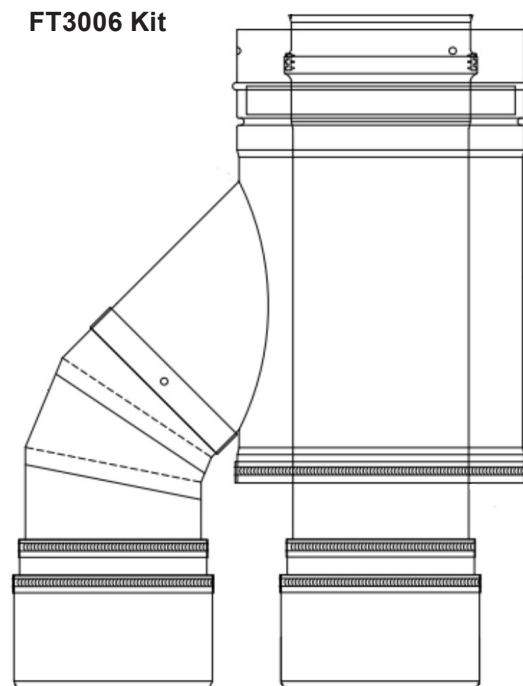
For a vertical venting system, locate the boiler to affect the shortest possible vent length run with the maximum venting length not to exceed 25 feet and no more than 3 90° elbows.

Venting Assembly Process:

Note: Follow the detailed instructions supplied with the Heat-Fab SC series venting components during the assembly process.

1) Install the Dual pipe to concentric adaptor, kit FT3006. Ensure that the fittings are clean, moisten the seals and pipe ends before insertion and insert the Dual pipe to concentric adaptor, kit FT3006 into the FT boiler sockets until they bottom out. Tighten the clamps on the boiler vent connectors.

2) The venting system will probably have both horizontal and vertical components to align the Dual pipe to concentric adaptor, kit FT3006, and the penetration through the roof.



3) The selection on the roof for the roof termination must follow the guidelines of Section 4.9 Vent / Air Termination, Page 22 in this manual.

4) Locate the FT boiler as close as possible to the site of the roof termination overhead and determine the routing of the venting system and measure the required lengths of horizontal and vertical runs.

5) Properly support each horizontal and vertical section at least every 4 ft and at each elbow. Finish the vertical section by the installation of the SCO3VT Vertical Terminal Adapter on the last piece of vertical concentric vent pipe.. The top of this adapter must be 12" above the roof or anticipated snow line where it penetrates the roof. Install a SCO3RC, Rain Cap.

6) After completion of the venting system, review all joints of the venting installation and make sure that all locking screws of the adjoining vent sections are all fully installed into the pre-drilled holes.

For a horizontal venting system do not exceed the maximum allowed lengths and number of elbows noted above and select a location for the vent termination on the outside wall. This location must consider the 12" height above grade and/or anticipated snow line and its proximity to windows, doors and sources of incoming air, etc. Reference Section 4.6 Locations for Vent Pipe Terminator, Page 18 in this manual.

Venting Assembly Process:

Note: Follow the detailed instructions supplied with the Heat-Fab SC series venting components during the assembly process.

1) Locate the FT boiler as close as possible to the selected location for the penetration through the outside wall and install the Dual pipe to concentric adaptor, FT3006 kit, in the sockets on the FT boiler. Ensure that the fittings are clean, moisten the seals and pipe ends before insertion and insert the Dual pipe to concentric adaptor, FT3006 kit, into the FT boiler sockets until they bottom out.

2) Determine the routing of the venting system and measure the required lengths of horizontal and vertical runs. Keep in mind that telescoping pieces may be required for certain lengths as the pipes can NOT be trimmed to length. Each vertical and horizontal run must be supported by hangers every 4 ft so that it slopes 3/8" per foot downward toward the FT boiler and has no low sections that will limit the flow of condensate back to the boiler.

3) The telescoping sections are used to adjust both the vertical and the horizontal sections of the pipes so that the proper slope can be maintained.

4) Install the 3" x 5" horizontal termination adaptor (SCO3HT) on the last piece of horizontal concentric vent pipe protruding through the exterior wall and select one of the listed horizontal terminations to complete the concentric venting installation.

5) After completion of the venting system, review all joints of the venting installation and make sure that all locking screws of the adjoining vent sections are all properly installed.

4.10.3 Stainless-Steel Concentric Venting Utilizing Existing Stainless Steel Venting.

There might be existing boiler installations that have a Heat Fab SC 3" x 5" concentric venting system. It might be possible to re-use portions of that venting system.

Carefully inspect the original system before deciding to use it. The near boiler portions of the venting system will need to be replaced in order to connect to the new FT boiler.

Determine the routing of the venting system and measure the required lengths of horizontal and vertical runs. Keep in mind that telescoping pieces may be required as most piping sections can not be trimmed to length.

NOTE: If the existing vent system is horizontal and terminated by a "Vent Terminal Extension" on the outside wall of the building, that "Vent Terminal Extension" including a downward exhaust termination is not appropriate for a condensing boiler like the FT Boiler and the entire system will need to be replaced.

Refer to Section 4.10.2 for detailed instructions for installing a completely new concentric stainless steel venting system. (See Section 4.10.4 for installing a completely new concentric Duravent PP concentric venting system).

If the existing venting system is a horizontal run, the slope of that system will need to be changed. As installed, that system required a downward slope of $\frac{1}{4}$ " per foot toward the outside wall. The venting system for FT boiler requires a slope of $\frac{3}{8}$ " per foot back toward the boiler so that condensate will drain back to the boiler and be eliminated. To change the slope, the vent pipe hangers will need to be adjusted or replaced.

The centerline of the flue on the FT boiler is 3.9" (99 mm) from the back of the boiler cabinet. The centerline of the flue on the existing boiler is 9" (229 mm) from the back of the boiler cabinet. If the FT boiler can be installed so that its cabinet back is 5" (127 mm) further forward from the back wall than the existing boiler, then the FT boiler vent and the venting system will be in alignment. If, however, the boiler location for the FT boiler, with respect to the back wall, cannot be

changed, 45° offset fittings will be required to bring the centerline of the FT vent forward to align with the existing vent assembly.

Venting Assembly Process:

NOTE: Follow the detailed instructions supplied with the Heat-Fab SC series venting components during the assembly process.

1) Start the vent assembly process by installing the Dual pipe to concentric adaptor, kit FT3006. (See previous page). Ensure that the fittings are clean, moisten and insert the Dual pipe to concentric adaptor into the FT boiler sockets until they bottom out. Tighten the clamps on the boiler vent connectors.

2) To create the offset, if necessary, moisten the internal gasket and insert the plain end of a SCO3E45 fitting into the socket end of another. Take care that the orientation is such that the offset is as indicated and the inserted end bottoms out in the other socket fitting. Install the self-tapping screws into the predrilled holes.

3) If the offset is required, clean mating surfaces with alcohol swap provided and moisten the socket gasket on the SCO3E45 assembly, and install the assembly onto the Dual pipe to concentric adaptor and secure with self-tapping screws. Clean with the swap and moisten with water. Moisten the seals on all the other seals throughout the Venting System assembly, as you move on.

4) The transition between the Dual pipe to concentric Adapter and the existing vent system will be made with P/N SCO3AJ telescoping adjustable concentric straight length to adjust to the difference between the location of the top of the Dual pipe to concentric Adapter and the bottom of the existing vent system. This adjustable length pipe is required regardless if the offset fittings are required or not. Install the SCO3AJ and adjust the length to connect to the remaining parts of the existing vent system and secure by installing the self-tapping screws in the pre-drilled openings.

5) After adjusting the slope, install a SCO3E90 elbow and a SCO3AJ telescoping adjustable concentric straight length to adjust to the existing horizontal venting. Adjust the SCO3AJ to connect to the existing vent system and secure by installing the self-tapping screws in the pre-drilled openings. (Refer to Table 6, page 25, for component descriptions).

4.10.4 New Installation of Duravent PPS Concentric System

The FT boiler has separate Combustion Air and Vent connections. Using the Parts Kits indicated in Table 7, the FT boiler can be connected with a Polypropylene Concentric Vent System for horizontal and vertical venting applications. Note that the entire venting system must slope back to the boiler 3/8" per foot for proper drainage of condensate. Do NOT allow any sags in the venting system.

For a vertical venting system, locate the FT Boiler as close as possible to the chosen vent location overhead, on the roof. The selection of the location for the roof termination must follow the guidelines of Section 4.9 Vent / Air Termination, Page 22.

For a horizontal venting system, locate the FT Boiler as close as possible to the chosen vent site near the outside wall of the building. This location must consider the 12" height above grade and/or maximum anticipated snow line and its proximity to windows, doors and sources of incoming air, etc. Reference Section 4.6 Locations for Vent Pipe Terminator, Page 18.

Venting Assembly Process:

Determine the routing of the venting system and measure the required horizontal and vertical runs. Keep in mind that telescoping pieces may be required as most piping sections can not be trimmed to length. Hangers and supports must be used every 4 ft so that the venting system slopes down back to the FT boiler by 3/8" per ft and no sags can be present in the venting system. Start the installation by installing the FT3002 Stub Out Kit directly in the FT Boiler Combustion Air and Vent connectors..

The 2 PP pieces of the FT3002 kit can be reduced in length, make sure to cut the exact same length from each piece, not to exceed 6-1/2". Assemble the parts

Stub-out Kit FT3002

ITEM NUMBER	QUANTITY	PART NUMBER	Description
1	1	820014497	Concentric Adaptor 80/80 - 80/125
2	1	820001613	3" Diameter PP 12" Pipe Length
3	1	820019072	3" Diameter PP 17.75" Pipe Length
4	2	810004167	3" Diameter 3" PVC Male to 3" PP
5	1	810004128	3" Diameter PVC Adaptor Clamp

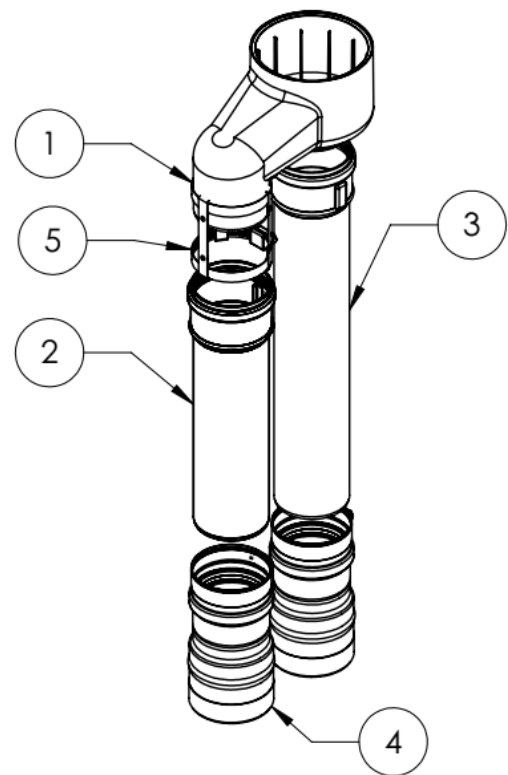
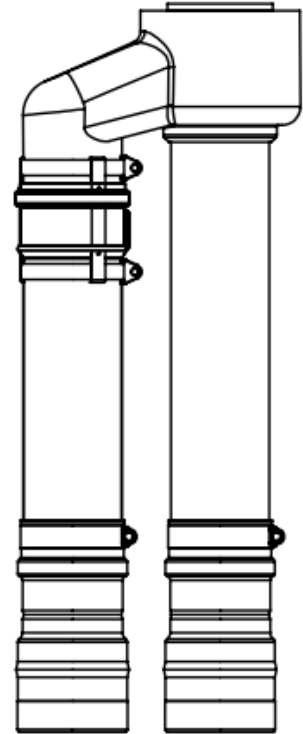
in the following order:

1) Insert a stainless steel to PP adaptor, (#4), into each of the FT boiler sockets and ensure that they bottom out in the sockets. Moisten the seals on the sockets to make the insertion easier and to avoid damaging the seals. Tighten the clamps on boiler vent connectors.

2) Insert item 820019072, (#3), 17.75" Straight Length, plain end through the top of the, (#1), Concentric Adapter. Do not connect it to the FT Boiler at this point.

3) Insert item 820001613, (#2), 12" Straight Length, into the stainless steel to PP adaptor on the Combustion Air socket and tighten the clamp.

4) Place the Concentric Adaptor, (#1), on top of the 12" pipe and align it so that the 17.75" PP pipe is aligned with the Vent socket on the FT Boiler.



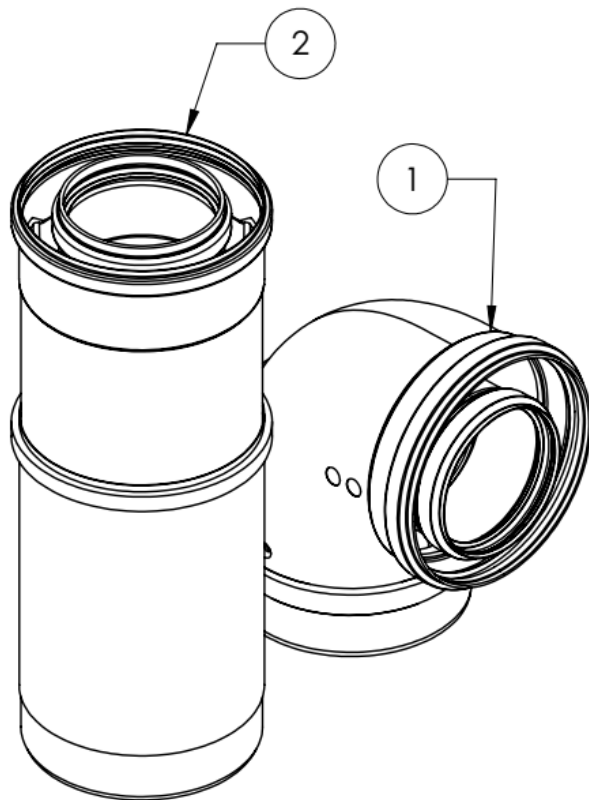
Slide the 17.75" pipe down through the stainless steel to PP adapter and connect it to the adapter on the FT boiler's Vent connection. Ensure that item #3 bottoms out and tighten the clamp.

5) Ensure that the 12" PP pipe is bottomed out in the P/N 820014497, (#1), and install the PVC Adaptor Clamp, (#5), Clamp and tighten both ends.

6) Place an 810005870, (#2), 3X5 Concentric Telescopic from a FT3004 Kit onto the FT3002 until it bottoms out.

FT3004 Concentric Telescopic piece + Elbow

ITEM NUMBER	QUANTITY	PART NUMBER	Description
1	1	810005865	3" x 5" Concentric 90° Elbow
2	1	810005870	3" x 5" Concentric Telescopic



7) Add the 810005865, (#1), 3X5 Concentric 90° elbow from the FT3004 Kit until it bottoms out. Adjust the length of the telescopic section as required.

8) Additional concentric Duravent PP components can be purchased from your local wholesaler.

9) The system from this point onward will probably be comprised of horizontal and vertical components for a vertical system. Another FT3004 kit can be used to adjust the lengths of both the horizontal and the vertical components of the system.

10) The required length of the horizontal or vertical sections may be created with the addition of straight lengths of 3PPC-P500 (19.69") and/or 3PPC-P1000 Concentric Pipe (39.37").

11) A vertical system will be terminated with the 3" x 5" concentric vertical termination, 3PPC-VCT.

12) A horizontal venting system will be terminated with the 3"x5" concentric horizontal termination, 3PPC-HCT.

4.10.5 Duravent PPS Concentric System to an existing Heat-Fab SC venting system

Fully read these instructions in order to connect to an existing Heat-Fab SC concentric stainless steel concentric venting system. Before starting the actual installation work, determine the routing of the new venting components and where these parts will connect to the existing components.

There might be existing boiler installations that have a Heat Fab SC 3" x 5" concentric venting system. It might be possible to re-use portions of that venting system.

Carefully inspect the original system before deciding to use it. The near boiler portions of the venting system will need to be replaced in order to connect to the new FT boiler.

NOTE: If the existing vent system is horizontal and terminated by a "Vent Terminal Extension" on the outside wall of the building, that "Vent Terminal Extension" including a downward exhaust termination is not appropriate for a condensing boiler like the FT Boiler and the entire system will need to be replaced.

Refer to Section 4.10.2 for detailed instructions for installing a completely new concentric stainless steel venting system. (See Section 4.10.4 for installing a completely new concentric Duravent PP concentric

venting system).

If the existing venting system is a horizontal run, the slope of that system will need to be changed. As installed, that system required a downward slope of 1/4" per foot toward the outside wall. The venting system for FT boiler requires a slope of 3/8" per foot back toward the boiler so that condensate will drain back to the boiler and be eliminated. To change the slope, the vent pipe hangers will need to be adjusted or replaced.

The centerline of the flue on the FT boiler is 3.9" (99 mm) from the back of the boiler cabinet. The centerline of the flue on the existing boiler is 9" (229 mm) from the back of the boiler cabinet. If the FT boiler can be installed so that its cabinet back is 5" (127 mm) further forward from the back wall than the existing boiler, then the FT boiler vent and the venting system will be in alignment. If, however, the boiler location for the FT boiler, with respect to the back wall, cannot be changed, 45° offset fittings will be required to bring the centerline of the FT vent forward to align with the existing vent assembly.

The FT boiler has separate Combustion Air and Vent connections. Using the Parts Kits indicated in the following instructions, it can be connected with a PP Concentric Vent System.

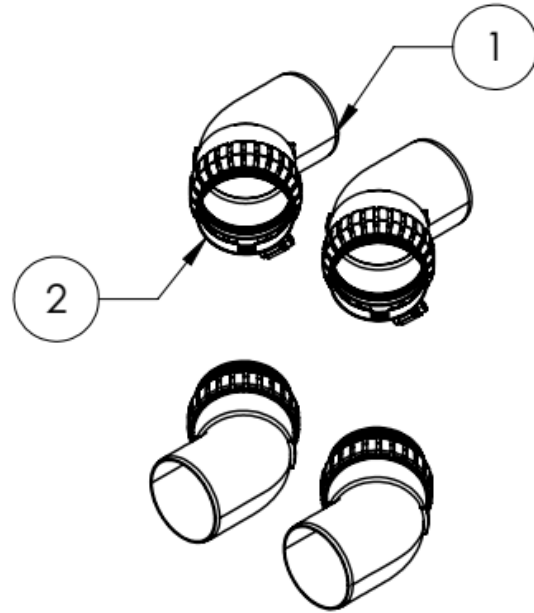
If this 5" offset in the venting system is required, it can be achieved in 2 ways.

Option 1: Assemble the elbows in an FT3001 Elbow Kit to form two offset assemblies. Ensure that the elbows bottom out and tighten the clamps.

Option 2: Use 2 45° Duravent concentric elbows (3PPC-E45) and install them in off-set fashion into the concentric venting as described below.

Venting Assembly Process:

1) Start the installation by installing only the 2 stainless to PP adapters of the P/N FT3002 Stub Out Kit, directly in the FT boiler Combustion Air and Vent sockets. Ensure that all connections bottom out and tighten the clamps on the boiler vent connectors.



FT3001 Offset Kit

ITEM NUMBER	QUANTITY	PART NUMBER	DESCRIPTION
1	4	810014537	3" Dia 45° Elbow - Single Wall
2	4	810014538	3" Dia Locking Clamp

2) If the above mentioned 5" offset is required, install now the 2 pre-assembled off-set assemblies into each stainless to PP adaptor. Then install the 2 PP lengths into the Stub-out kit (FT3002)(Option 1 solution for off-set).

Note: Do not overtighten the connections until the entire system is put together.

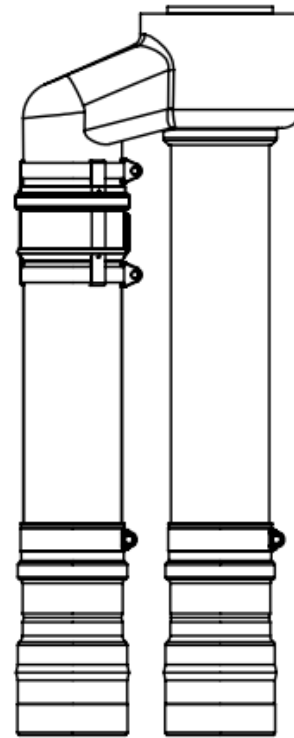
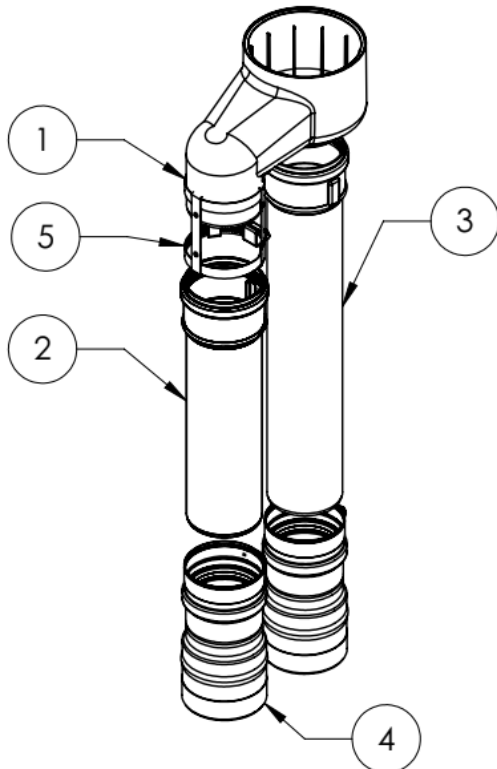
3) If FT3001 Elbow kit is not required, the complete Stub-out kit (FT3002) can be installed or off-set option 2 is selected, the length of the 2 PP portions can be shortened; make sure to cut the same length from each pipe. Do not cut more that 6-1/2" from each pipe.

Assemble the parts in the following order:

4) Insert the 3" stainless steel to PP adapters into the 2 3" vent connections on top of the FT Boiler until they bottom out into the sockets.. Moisten the seals on the sockets to make the insertion easier and to avoid damaging the seals. Tighten the clamps on the boiler

Stub-out Kit FT3002

ITEM NUMBER	QUANTITY	PART NUMBER	Description
1	1	820014497	Concentric Adaptor 80/80 - 80/125
2	1	820001613	3" Diameter PP 12" Pipe Length
3	1	820019072	3" Diameter PP 17.75" Pipe Length
4	2	810004167	3" Diameter 3" PVC Male to 3" PP
5	1	810004128	3" Diameter PVC Adaptor Clamp



the clamp.

vent connectors.

5) Insert the, 17.75" Straight Length, plain end PP pipe through the top of the, (#1), concentric PP adaptor. Do not connect it to the FT boiler or FT3001 Elbow, if used, at this point.

6) Insert the straight length PP pipe, Into the adaptor on the Combustion Air socket or FT3001 Offset Elbows and tighten the clamp.

7) Place the (#1), Concentric adapter on top of the 12" pipe and align it so that the 17.75" pipe is aligned with the Vent socket on the FT boiler or the FT3001 Offset Elbow, if used. Slide the 17.75" pipe down through the adapter and connect it to the adapter on the FT boiler's Vent connection or the FT3001 Offset Elbow, if used. Ensure that it bottoms out and tighten

8) Ensure that the 12" pipe is bottomed out in the Concentric Adaptor, (#1), and install the, (#5), Clamp and tighten both ends.

9) Option 2 for offset (if required): Install 2 45 concentric PP elbows (3PPC-E45) in an off-set fashion on top of the concentric adaptor. Make sure the different components are fully engaged and bottom out.

10) Depending on where you need to connect to your existing Heat-Fab SC concentric venting system, use the components in the FT3004 kit to either vertically or horizontally adjust. (See page 29).

11) Use FT3003 kit (PP to Heat-Fab adaptor) to connect the Duravent PP concentric system to the existing Heat-Fab SC venting system. Moisten the seals with water prior to assembly. See image of FT3003 kit on the next page.

12) After completing the venting installation, review all joints, check for proper slope on each horizontal section and make sure each section is properly supported per vent manufacturer's instructions.

FT3003 PP to Heat-Fab Kit

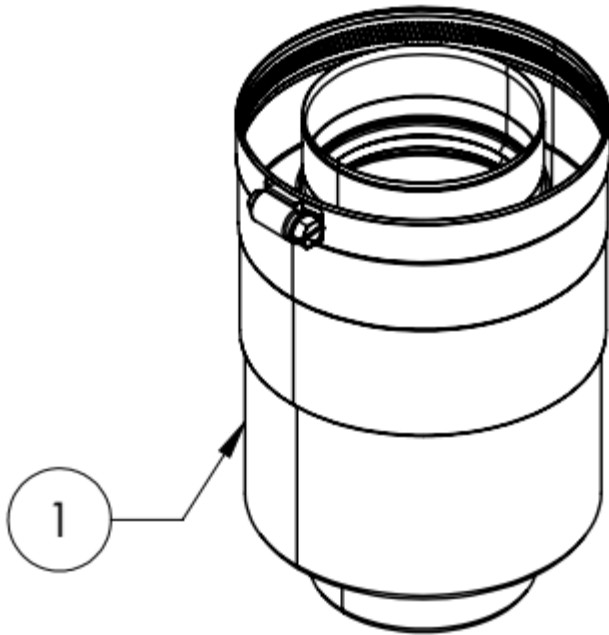


Table 8: Approved components for use in 3" Vertical PP Flex venting.

Part Number	Description
3PPS-FLEX50	3" Diameter 50' Flex PP
3PPS-FKC	3" Flex kit
3PPS-72C	3" 6' PP Pipe
3PPS-E90C	3" PP elbow
3PPS-03PVCM-3PPF	3" PVC Male to 3" PP
3PPS-FAC	3" Flex coupler
3PPS-FKC	3" Flex chimney lining kit

(Venting parts available through your local wholesaler).

4.10.6 Flexible Chimney Liner Venting

A masonry chimney may be used as a chase for vertically venting the FT boiler. The parts and instructions are available from DuraVent distributors. Please refer to the Table 8. The vent parts used within the chimney must all be PP Flex components and be installed in accordance with the detailed Installation Instructions provided with the parts. Those instructions are for the installation of the vent from the top of the chimney (including the Termination) to a point at the bottom of the chimney. From this point, use single wall PP pipe to connect to the exhaust connection on the boiler.

For FT Boilers replacing boilers utilizing B Vent chimneys, parts are also available to use the existing B Vent chimney as a chase for the PP Flex. As with the masonry chimney, the PP Flex is only used within the chimney and must be connected to rigid PP pipe from that point to the exhaust connection of the FT Boiler. Three (3) 90 degree elbows and up to 15 ft feet of rigid 3" PP pipe are allowed.

3" rigid PP pipe is required from the bottom of the PP Flex liner to the exhaust connection of the FT Boiler. The maximum allowable length of PP Flex pipe is 50 feet of three (3) inch diameter Flex pipe.

4.11 Gas Supply and Piping

Gas piping should be supported by suitable hangers or floor stands, by the appliance.

Review the following instructions before proceeding with the installation.

1. Verify that the appliance is fitted for the proper type of gas by checking the rating plate. FT will function properly at elevations up to 10,000 feet (3050 m). Refer to Section 4.13 for High Altitude Settings.
2. For minimum and maximum supply pressures, see Table 9 on page 36
3. Refer to Tables 6, 7 and 8 for proper gas pipe sizing.
4. Run gas supply line in accordance with all applicable codes.
5. Locate and install manual shutoff valves in accordance with state and local requirements.
6. A sediment trap must be provided upstream of the gas controls.
7. All threaded joints should be coated with piping compound resistant to action of liquefied petroleum gas.
8. The appliance and its individual shutoff valve must be disconnected from the gas supply piping during any pressure testing of that system at test pressures in excess of 1/2 PSIG (3.45kPa).
9. The unit must be isolated from the gas supply system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or greater than 1/2 PSIG (3.45kPa).
10. The appliance and its gas connection must be leak tested before placing it in operation.
11. Purge all air from gas lines.

CAUTION

PRV (included) must be installed immediately at the brass adaptor, which itself must be installed at the top of the boiler outlet, without any valves in between. Refer to Section 4.17.

ATTENTION

PVR (inclus) doit être installé sur l'adaptateur de brass immédiate à la sortie de la chaudière. On doit pas installer un vane entre le PVR et la chaudière. Se reporter à la section 4.17

WARNING:

Open flame can cause gas to ignite and result in property damage, severe injury, or loss of life.

NOTE: The FT appliance and all other gas appliances sharing the gas supply line must be firing at maximum capacity to properly measure the inlet supply pressure. The pressure can be measured at the supply pressure port on the gas valve. Low gas pressure could be an indication of an undersized gas meter, undersized gas supply lines and/or an obstructed gas supply line.

SCH 40 METAL PIPE CAPACITY FOR 1.50 SPECIFIC GRAVITY UNDILUTED PROPANE			
NOMINAL PIPE SIZE @ 11" W.C. INLET AND 0.5" W.C. PRESSURE DROP			
SIZE	1/2"	3/4"	1"
LENGTH	MAXIMUM CAPACITY IN THOUSANDS OF BTU PER HOUR		
20	200	418	787
40	137	287	541
60	-	231	434
80	-	197	372
100	-	175	330

NOTES: 1. Follow all local and national propane gas codes for line sizing and equipment requirements. 2. Verify that inlet gas pressure remains between 4 and 13 inches of water column before and during operation.
Source: ANSI Z223.1-80 National Fuel Gas Code.

Table 6. Nominal Pipe Size, Propane

SCH 40 METAL PIPE CAPACITY FOR 0.60 SPECIFIC GRAVITY NATURAL GAS		
NOMINAL PIPE SIZE @ 0.30" W.C. PRESSURE DROP		
LENGTH	3/4"	1"
FT	CUBIC FEET OF GAS PER HOUR	
20	190	350
40	130	245
60	105	195
80	90	170
100		

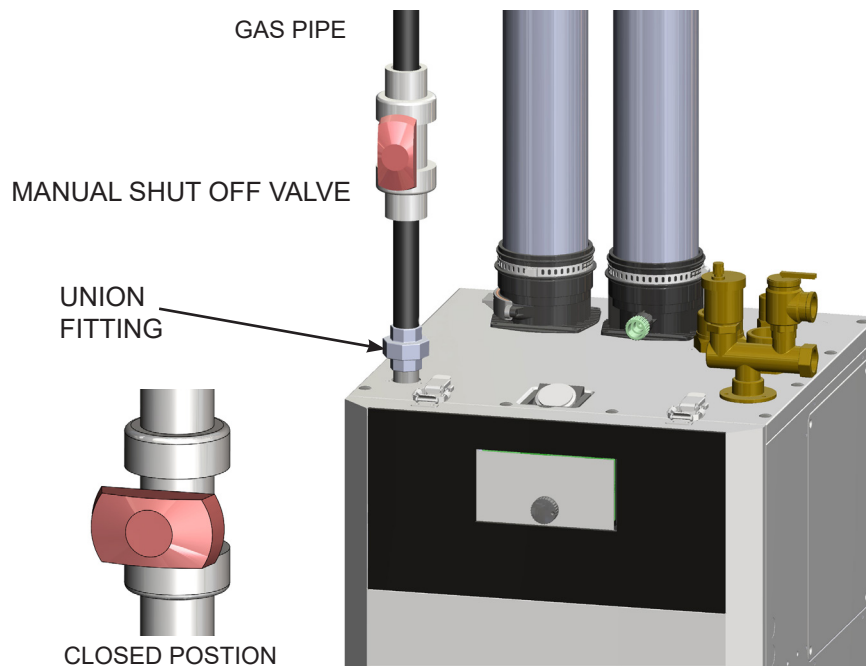
Table 7. Nominal Pipe Size, Natural Gas

EQUIVALENT LENGTHS OF STRAIGHT PIPE FOR TYPICAL SCH 40 FITTINGS			
NOMINAL PIPE SIZE			
FITTING	1/2"	3/4"	1"
LINEAR FEET			
90° ELBOW	3.6	4.4	5.2
TEE	4.2	5.3	6.6

Table 8. Equivalent Pipe Lengths

4.11 Gas Supply and Piping (cont)

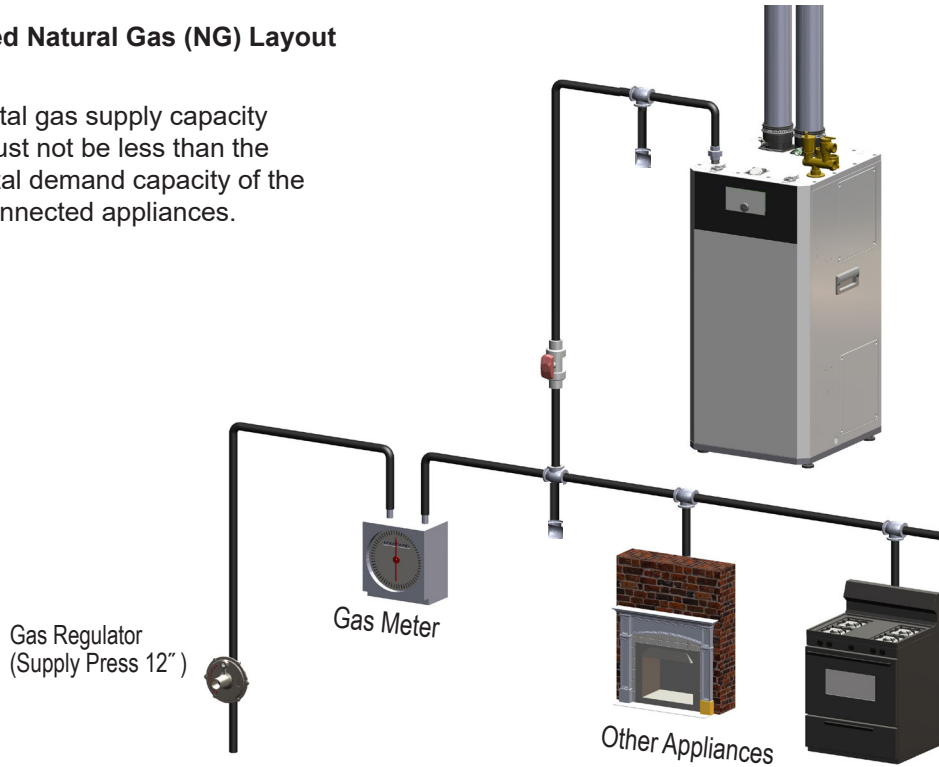
- The gas connection fitting is, **3/4" male NPT** on FTFCF199 models.
 - The supply line must be sized for the maximum output of the combination boiler model being installed. If there are additional gas appliances from the main supply line, you must measure connected on the same main gas supply line, according to the **COMBINED** total maximum BTUH draw for the appliances as if they were all operating at the same time.
 - Measure the length of the gas supply line from the gas meter to the Combination boiler. Use the tables in this manual or refer to the gas line manufacturers sizing information to determine the correct supply pipe size.
 - The manual gas shut-off valve in the gas supply line should be installed close to the unit as shown below.
- 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 3/4" male NPT connection on the Combination boiler.
 - 1) Install an approved gas line pipe to gas line connection gas Combination boiler . Include manual shut off valve and gas union on top of the connection, as shown.
 - 2) Test gas pressure to make sure it meets the minimum standards and does not exceed the maximum standards for the combination boiler.
 - 3) Leak test the gas line pipe before placing the unit in operation. Use approved leak detector liquid solutions only to check for leaks.
 - Do Not Operate the combination boiler until all connections have been completed, checked for leaks, and the heat exchanger is filled with water.



**Gas Line Shut Off
Valve Detail**

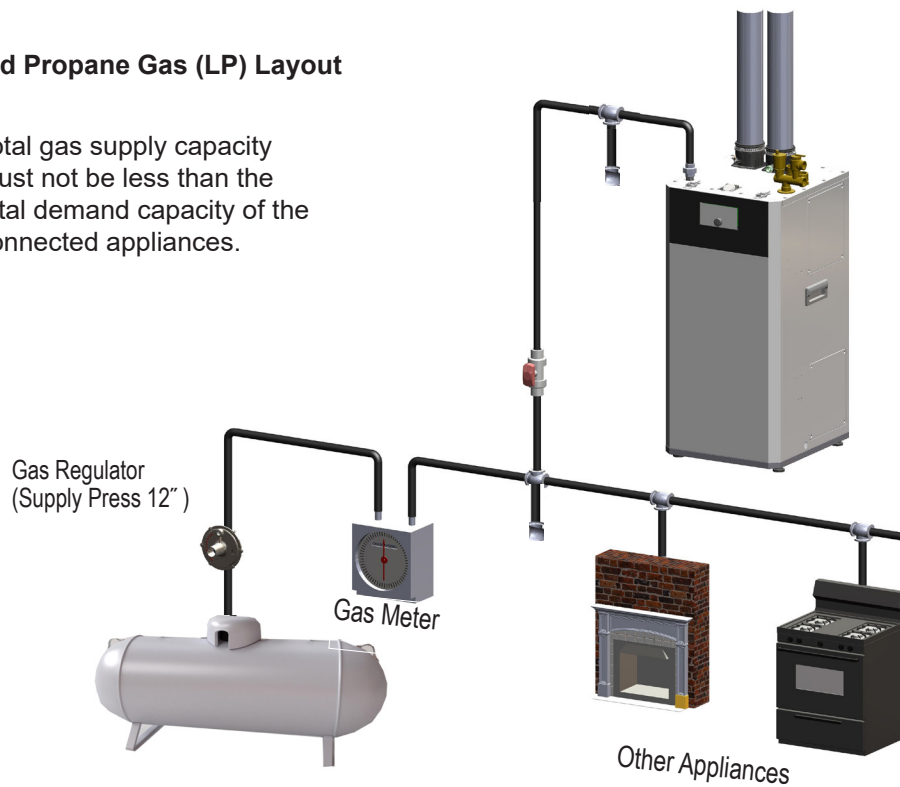
Suggested Natural Gas (NG) Layout

NOTE: Total gas supply capacity must not be less than the total demand capacity of the connected appliances.



Suggested Propane Gas (LP) Layout

NOTE: Total gas supply capacity must not be less than the total demand capacity of the connected appliances.



- The combination boiler must be installed downstream of the gas meter for adequate gas supply.
- The gas piping must not be less than **3/4" female NPT** on FTCTF199 models.

4.12 Gas Supply Pressure

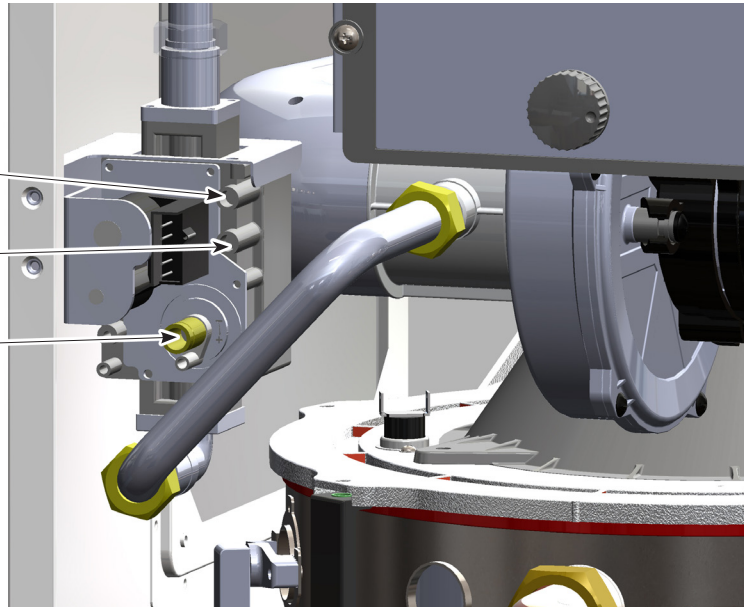
Refer to the illustration.

Inlet Gas Pressure Port

Gas Outlet / Manifold Pressure Port

Offset Adjustment.

Do Not Adjust without using a combustion analyzer to verify adjustment. Adjust ONLY when in MIN Fire and when using a combustion analyser. See Section 4.12 for step by step details.



- The Maximum and Minimum gas line pressures must be at Max Fire operation.

LP Gas		Natural Gas	
Maximum Pressure	13.0" WC	Maximum Pressure	10.5" WC
Minimum Pressure	8.0" WC	Minimum Pressure	3.5" WC

Table 9. Gas Supply Pressures

⚠ CAUTION

- The appliance and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of the system at test pressures in excess of 1/2 psi (3.5 kPa).
- Loosen the pressure port screws before you check the gas inlet pressure.

4.13 Adjusting Combustion

1. Remove the front cover by opening the two clips on the top of the boiler front cover - tilt forward and lift the cover off.
2. Turn ON the GAS and WATER supply to the FT.
3. Turn ON the FT.
4. Ensure your FT is set for the correct altitude. The default setting is for altitudes of 0~1,999 ft above sea level. If your FT floor is installed at an altitude of 2,000 ft, or greater the correct altitude setting should be set according to Section 4.14 of the FT Install and Operating Manual (Floor) before you continuing tuning this unit.
5. Check gas inlet pressure at inlet pressure port. (See previous page).
6. Establish a call for heat. You may need to disconnect the outdoor reset if you are making this gas conversion during warm weather.
7. Connect a manometer to the manifold pressure port. For dual port manometers, use the positive pressure side. Check for proper manifold gas pressure. Refer to Table 11, page 38.
8. Setup your combustion analyser and place the sensor into the combustion test port
9. Per Section 4.14 for Max Fire, change dip switch 6 to ON. The unit will cycle up to MAX fire.
10. WAIT for your combustion analyser to stabilize. This may take up to 3 minutes depending on your combustion analyser. Then check the CO₂ measurement for MAX Fire. Refer to Table 10 for acceptable MAX fire combustion readings **Do NOT attempt to adjust CO₂ at MAX Fire. ONLY adjust CO₂ in MIN Fire operation.**
11. For MIN Fire, change dip switch 6 to OFF and 7 to

ON. The unit will cycle down to MIN Fire.

Note: When in Low Fire the burner should remain on. If the flame dies out after a few seconds while in Low Fire the gas input to the burner is too lean and will need to be increased slightly by using the offset adjustment. Turn the offset adjustment 1/8" clockwise and allow burner to cycle. Only adjust clockwise until the burner is able to remain lit. Once stable on Low Fire continue onto Step 12.

12. WAIT for your combustion analyser to stabilize. Then check the CO₂ measurement for MIN fire. Refer to Table 10 for acceptable MIN fire combustion readings.
13. Open the Gas Valve Adjustment Port by removing the cap screw with a # T15 wrench.
14. Then use the # T15 wrench to make a minor adjustment (1/8 turn) to either increase or decrease CO₂. See 4.12 on page 36.
15. It may be necessary to go back and forth between HI Fire and LOW Fire several times (and adjusting only at LOW Fire), before CO₂ at both are within acceptable levels. Be sure to put the adjustment port cap screw back onto the valve when done.
16. Once the CO₂ and manifold pressure measurements for both MIN and MAX Fire are acceptable per Table 10, set DIP switches 6 and 7 to the OFF position for Nominal Fire (normal operation).
17. Remove your combustion analyser from the Test Port and be sure to thread the Test Port plug back into position.
18. Re-connect outdoor reset if it was disconnected, put the boiler cover back on and secure the clips that hold the cover in place.

Standard Factory Setting is for MAX Fire. 9.0% CO₂ @ 0-2,000 ft altitude (Natural Gas).

 **WARNING**

Installer is required to verify combustion settings as part of the installation process.

CO ₂ value		Natural Gas (NG)		Propane Gas (LP)	
		2" VENT	3" VENT	2" VENT	3" VENT
FTCF (ALL Sizes) (and all altitudes)	MAX FIRE	8.5 - 10.5%		9.5 - 11%	
	MIN FIRE	8 - 10%		9 - 10.5 %	

Table 10. CO₂ Values

Adjusting Combustion (continued)

Manifold Pressure		Natural Gas		Liquid Propane	
		2" VENT	3" VENT	2" VENT	3" VENT
FTHF199	Max Fire	-0.129" WC	-0.314" WC	-0.169" WC	-0.173" WC
	Min Fire	-0.015" WC	-0.015" WC	-0.015" WC	-0.015" WC



Table 11. Manifold Pressures

Note: Values in the range of -.001 to -.35 inches of WC are indicative of proper set-up. If your values are outside this range, call technical support.

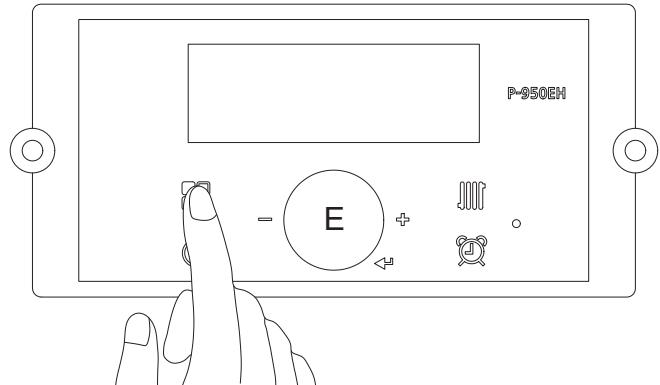
4.14 High Altitude Installations. 2,000' to 10,000'

The FT is shipped with a default factory setting for installation at an altitude of 0 to 2000' (approx). For maximum efficiencies at higher altitudes (2,000' to 10,000'), the FT Boiler has an adjustment in the Installer Parameters Mode.


Follow these instructions if your installation is at 2,000' - 10,000'.

1. With the Power  turned OFF, press the 'Modes button'  for 5 seconds to get into the Installer Parameters Mode.
2. Turn the dial (E) until '**33:HA**' appears.
3. Press the dial (E).
4. Select the proper high altitude value by turning the dial.

#	Altitude of Installation
0 - 2	0 - 2,000 ft (0 - 609 m)
2 - 5	2,000 - 5,000 ft (609 - 1,522 m)
5 - 8	5,000 - 8,000 ft (1,522 - 2,436 m)
8 - 10	8,000 - 10,000 ft (2,436 - 3,045 m)



Refer to table.

5. Press the dial again (E) to save the setting.
6. Press the 'Modes button'  and the display will turn off.
7. Push the power button on the display to turn the boiler back on.

4.15 Natural Gas to Propane Conversion

The FT floor standing, condensing boiler is configured for Natural Gas (NG) from the factory. A Propane Conversion Kit is included with every FT. The gas conversion kit will show you how to convert your FT boiler to propane gas. If your FT does not have the bag containing the conversion kit, a replacement kit can be obtained. Contact the manufacturer and request a replacement conversion kit.

NOTICE

If your installation altitude is greater than 2000ft, check that the “High Altitude” Installer setting has been adjusted to suit your installation altitude. See section 4.14.

WARNING

This gas conversion kit shall be installed by a qualified service agency in accordance with the manufacturer’s instructions and all applicable codes and requirements of the authority having jurisdiction. The information in these instructions must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury or death. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer’s instructions supplied with the kit. Installation must conform to local codes and the latest edition of the National Fuel Gas Code, ANSI Z223.1 and CAN-B149.1. Failure to follow instructions could result in serious injury or property damage. The qualified agency performing this work assumes responsibility for gas conversion.

CAUTION

This boiler has already been set to burn natural gas, but can be converted to burn LP gas. Before placing the combination boiler into operation, verify that the proper type of gas is supplied to your combination boiler.



1. Open 2 toggle latch clamps fixed to the upper case of the product. Remove the front door from the product by lifting it upwards while tilting it by about 30°.
2. Turn OFF the FT. The ON / OFF button is located behind the front cover on the left front side of the appliance.
3. Turn OFF the GAS and WATER supply to the FT (valves are located on the plumbing pipes.)
4. Locate the Gas Inlet Pipe at the top left of the unit as shown in Figure A, and loosen the Brass Fittings at both ends of the Gas Inlet Pipe. See Figure B.
5. Completely unthread the brass fitting on the blower end of the Gas Inlet Pipe and then carefully swing the Gas Inlet Pipe to the left or right, just enough so that it is out of the way. See Figure B.
6. Remove the existing natural gas nozzle or orifice. If your unit is a 199, note that the flat side of the orifice is towards the blower. Save the packing for re-use. See Figure C.


Model	Natural Gas (NG) part #	Propane Gas (LP) part #	Orifices
FTCF 199	FT1780	FT1802	
	Natural Gas 8.3mm	Liquid Propane Gas 6.35mm	

Table A Gas Conversion Parts

4.15 Natural Gas to Propane Conversion (cont)

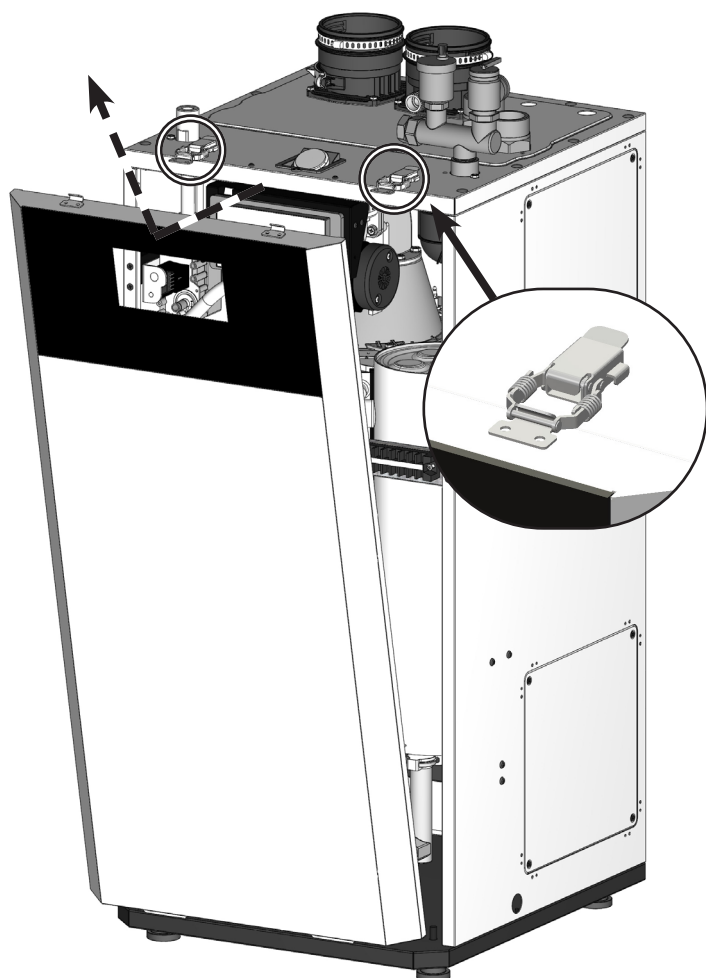


Figure A

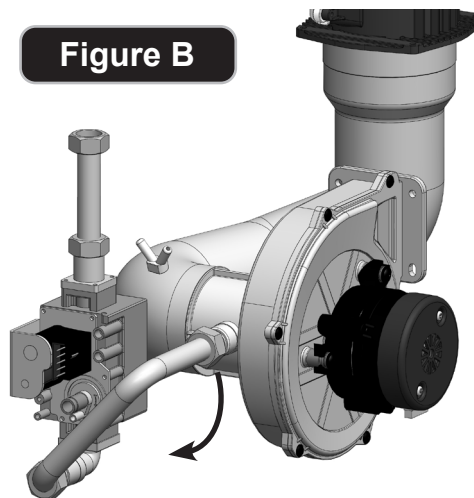


Figure B

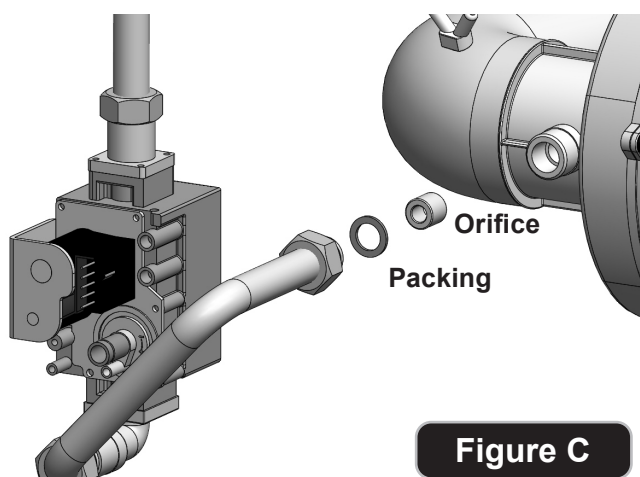
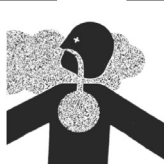


Figure C

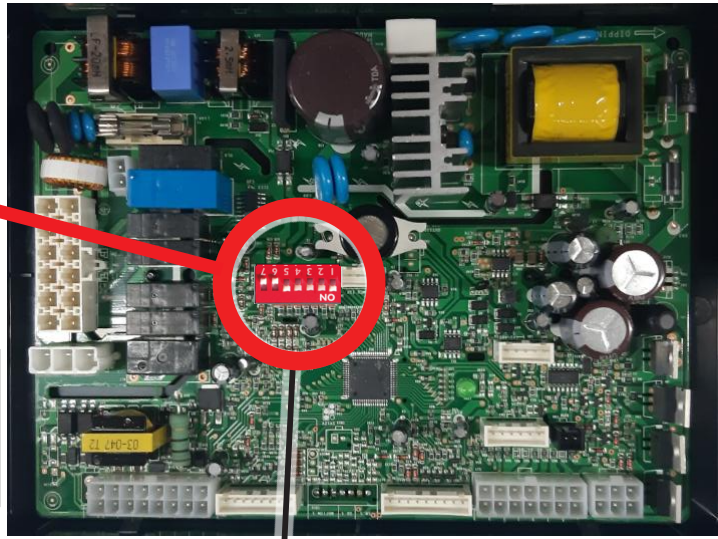
This conversion shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, an explosion or production of carbon monoxide may result causing property damage, personal injury or loss of life. The qualified service agency is responsible for the proper and complete installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer's instruction supplied with the kit. Installation must conform to local codes and the latest edition of the National Fuel Gas Code, ANSI Z223.1 and CAN-B149.1. Failure to follow instructions could result in serious injury or property damage. The qualified agency performing this work assumes responsibility for gas conversion.



Ce conversion doit être installé par un organisme de service conformément aux instructions du fabricant et tous les codes et les exigences de l'autorité compétente. Si les informations contenues dans ces instructions n'est pas suivi à la lettre, un incendie, une explosion ou de la production de monoxyde de carbone mais résultat causant des dommages matériels, des blessures ou des pertes de vie. Le service est responsable pour la bonne et complète l'installation de ce kit. L'installation n'est pas correcte et complète jusqu'à ce que le fonctionnement de l'appareil converti est vérifiée comme spécifié dans le manuel d'instruction fourni avec le kit. L'installation doit être conforme aux codes locaux et la dernière édition du National Code de gaz combustible, ANSI Z223.1 et peut-B149.1. Non-respect des instructions peut entraîner des blessures graves ou des dommages matériels. L'organisme qualifié effectuant ce travail suppose la responsabilité de conversion au gaz.

4.15 Natural Gas to Propane Conversion (continued)

Shown is a Model 199 Natural Gas with 3" Venting.



7*	6*	5	4	3	2	1
OFF	OFF	LP Gas	2" Vent			
Low Fire	High Fire	Natural Gas	3" Vent	FACTORY SET		

Table B Dip Switch Settings

*Dip Switches #7 and #6 are Maximum and Minimum fire test Switches which are used only when setting up combustion (See Section 4.13) These Switches should only be in the ON position during either High or Low fire Testing. When finished testing, ensure both of these switches are in the OFF position.

Dip Switches #1, 2 and 3 are Set at the factory and should not need adjusting. For Reference the correct positions of these three switches are as follows:
 Model FTHF199 : All three dipswitches should be in the "down"/ ON position. As shown above.

7. Install the new LP (propane) orifice. Re-use the existing gasket. Install the LP orifice with its identifying mark facing inward.
8. Return the Gas Inlet Pipe to its original position and tighten both brass fittings.
9. Per Table B, set DIP Switch 5 to OFF for LP Propane.
10. Turn ON the GAS and WATER supply to the FT
11. Now start the unit and adjust combustion as described in Section 4.12
12. Upon completion of set up, write in the correct Conversion Date and the Technicians Name to the included gas conversion sticker. See Figure F. Then apply that sticker adjacent to the rating plate.

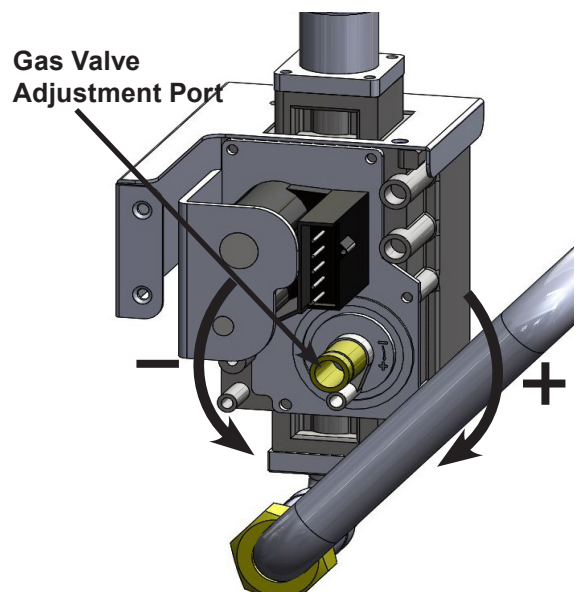


Figure E

4.15 Natural Gas to Propane Conversion (continued)

NOTE: Installer is required to verify combustion settings as part of the installation process.
CO should not exceed 200 ppm.

CO ₂ value		Natural Gas (NG)		Propane Gas (LP)	
		2" VENT	3" VENT	2" VENT	3" VENT
FTHF (ALL Sizes) (and all altitudes)	MAX FIRE	8.5 - 10.5%		9.5 - 11%	
	MIN FIRE	8 - 10%		9 - 10.5 %	

Manifold Pressure		Natural Gas (NG)		Propane Gas (LP)	
		2" VENT	3" VENT	2" VENT	3" VENT
FTHF 199	MAX FIRE	-0.129"WC	-0.314"WC	-0.169"WC	-0.173"WC
	MIN FIRE	-0.015"WC	-0.015"WC	-0.015"WC	-0.015"WC

NOTE: Values in the range of -.001 to -.35 Inches WC are indicative of proper set-up. If your values are outside this range, call technical support.

This unit was converted on ___/___/___ to ___gas with kit # _____ by _____ (name and company _____ accountable) _____ Cette unité a été converti ___/___/___ ten ___gaz en utilisant le kit numéro _____ par _____ (nom et société _____ responsable) _____ _____

Figure F (Conversion label)

4.16 Plumbing Guidelines

4.16.1 External Plumbing and Water Connection Guidelines

- Ensure pipe material meets local codes and industry standards.
- The pipe end must be clean and free of debris.
- Do not apply torch heat within 12" of the top connections of the unit.
- The Boiler supply and return connections are 1-1/2" NPT. System piping should be sized based on your design load and flow requirements. Refer to sections 4.16.4 through 4.16.8 for details.
- Isolation valves (shutoff valve) will be used.
- All piping should be insulated.

4.16.2 Applicable Backflow Preventer

- Apply a backflow preventer valve in the DHW supply inlet (water Inlet) to the unit as required by local codes.

4.16.3 Diaphragm type Expansion tank and external LWCO mounting.

- The air in a diaphragm-type expansion tank is separated from the water by a flexible rubber membrane. When the tank is installed in and connected to the piping of the system, water enters the other side of the tank chamber and presses down on the diaphragm.
- You should always install an 'Automatic Air Vent on the top of the air separator to remove residual air from the system.
- Install the supplied brass adaptor, automatic air vent and relief valve on the top front right piping connection.
- If an external LWCO is required/ desired, the horizontal body of the brass adaptor fittings has a 3/4" connection for a remote LWCO.



- The built-in LLH allows direct piping of system supply and return connections to their respective connections on top right side of the boiler. This greatly simplifies near boiler piping in a replacement application. Do NOT use primary/secondary piping!
- CH pipe size : 1 1/2"



For guidelines in the use of Glycol Products. Please refer to Section 8.4 on page 81



Scalding Risk: Manufacturer strongly recommends the installation of an anti-scald mixing valve at domestic hot water outlet (indirect tank location) to reduce potential for scalding.













Check with local codes.

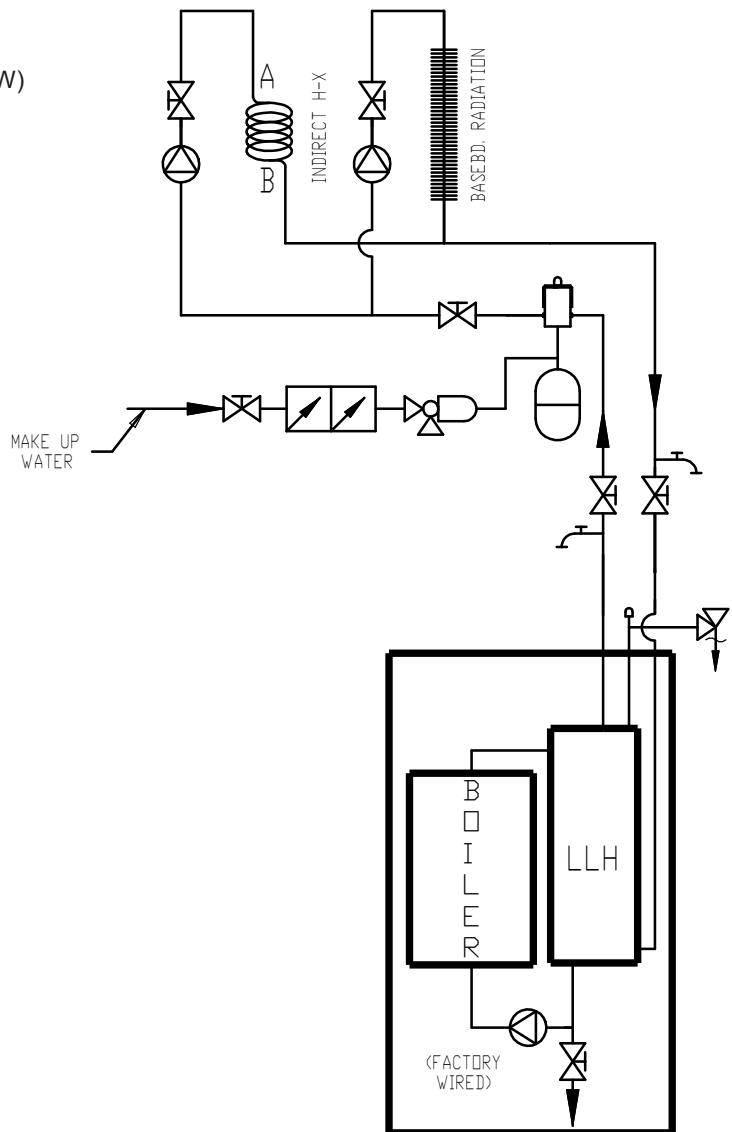


Plumbing Guidelines (continued)

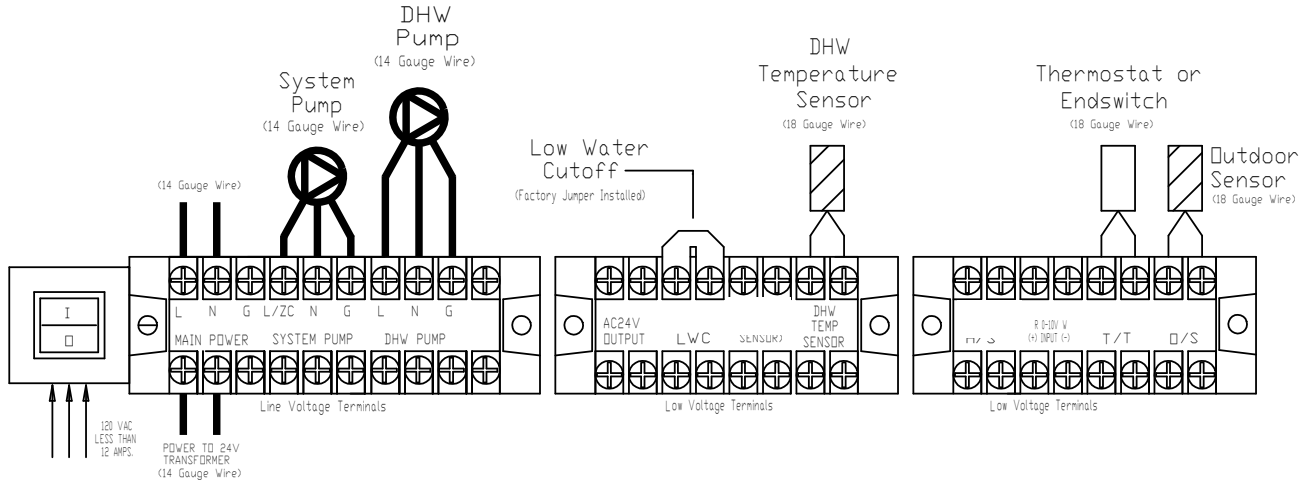
4.16.4 Single zone heating and indirect DHW tank

1. This piping diagram is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. The minimum size of the piping to the Indirect Tank Heat Exchanger is 3/4" inside diameter.
3. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
4. Manufacturer strongly recommends the use of an anti-scald mixing valve at the domestic hot water (DHW) outlet from the Indirect Tank to reduce potential for scalding. Check with local codes.

	Expansion tank (Diaphragm-type)
	Automatic air vent
	Air separator
	Circulation pump with built-in IFC
	Check Valve
	Drain valve
	Shut-off valve
	Backflow preventer
	Pressure Relief Valve
	Anti-scald rated Mixing Valve
	Zone valve
	Pressure reducing valve



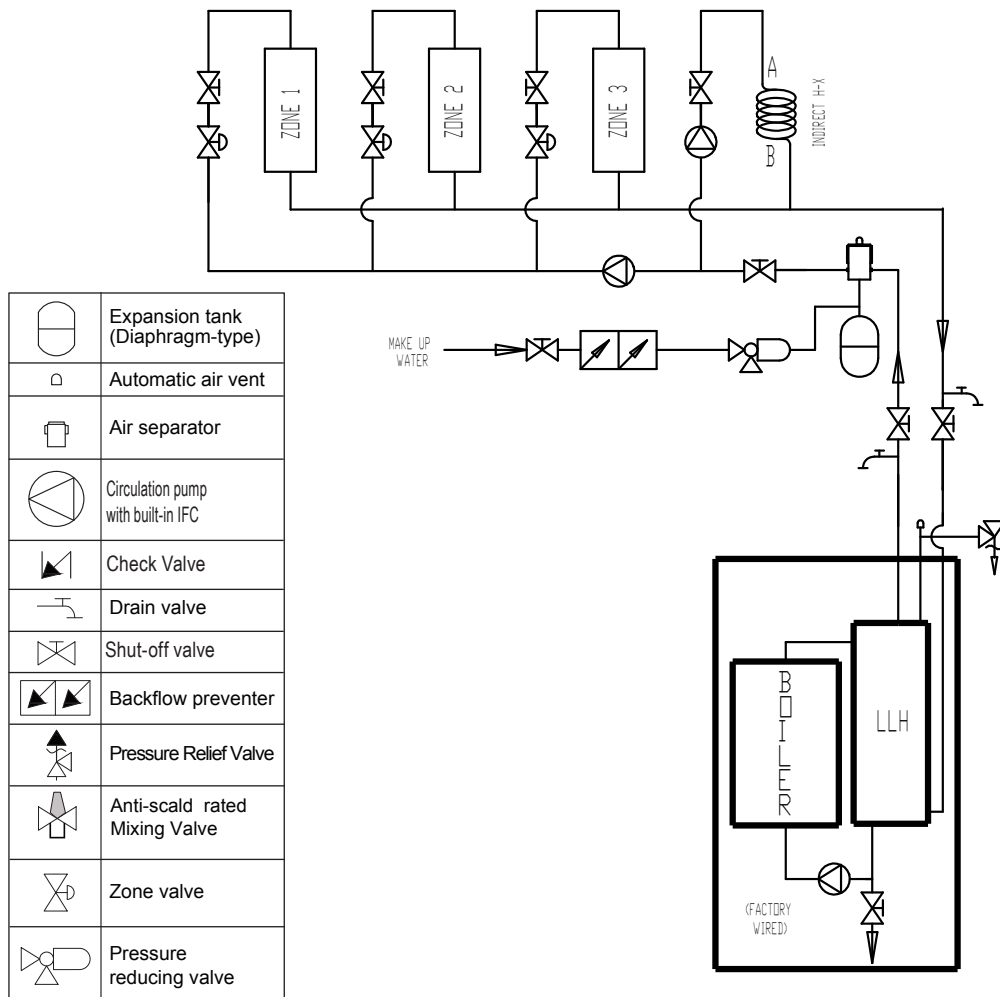
Wiring, Single Zone Heating with Indirect DHW Tank



1. Do not bring 24 V to any terminals on the FTHF boiler. The room thermostat (dry contacts only) connects back to the T/T terminals.
2. The Indirect Tank temp sensor connects to the DHW TEMP SENSOR terminals. Connect the system pump and DHW pump as shown above.
3. The tank aquastat or DHW sensor connects back to the DHW sensor terminals. Use parameter 39 in Section 5.7 to define aquastat or DHW sensor setting to the boiler.
4. Connect the outdoor sensor (OS) for outdoor reset operation to the O/S terminals.

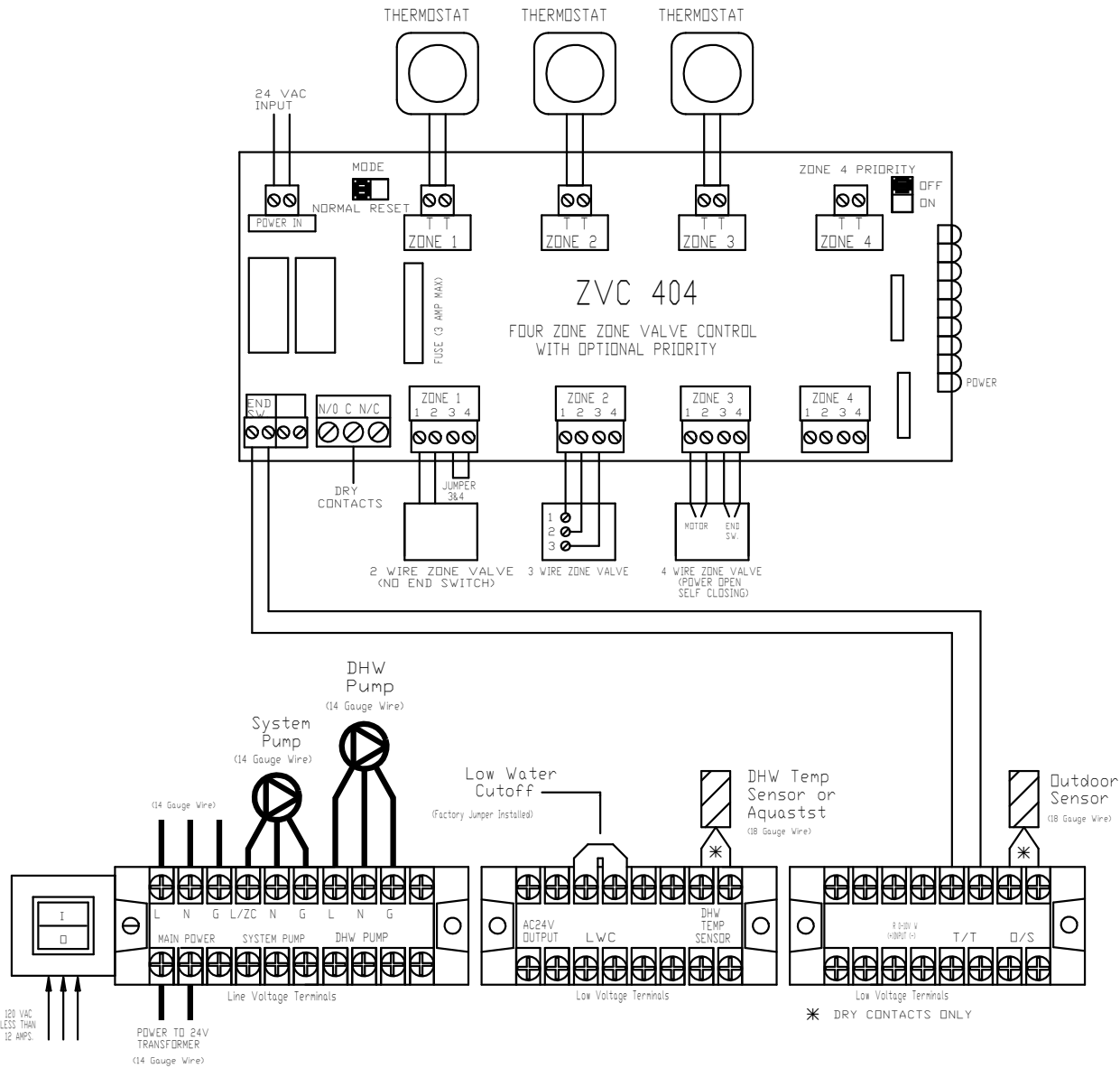
Note: This space is intentionally left blank.

4.16.5 Zoning with zone valves and indirect DHW tank pump.



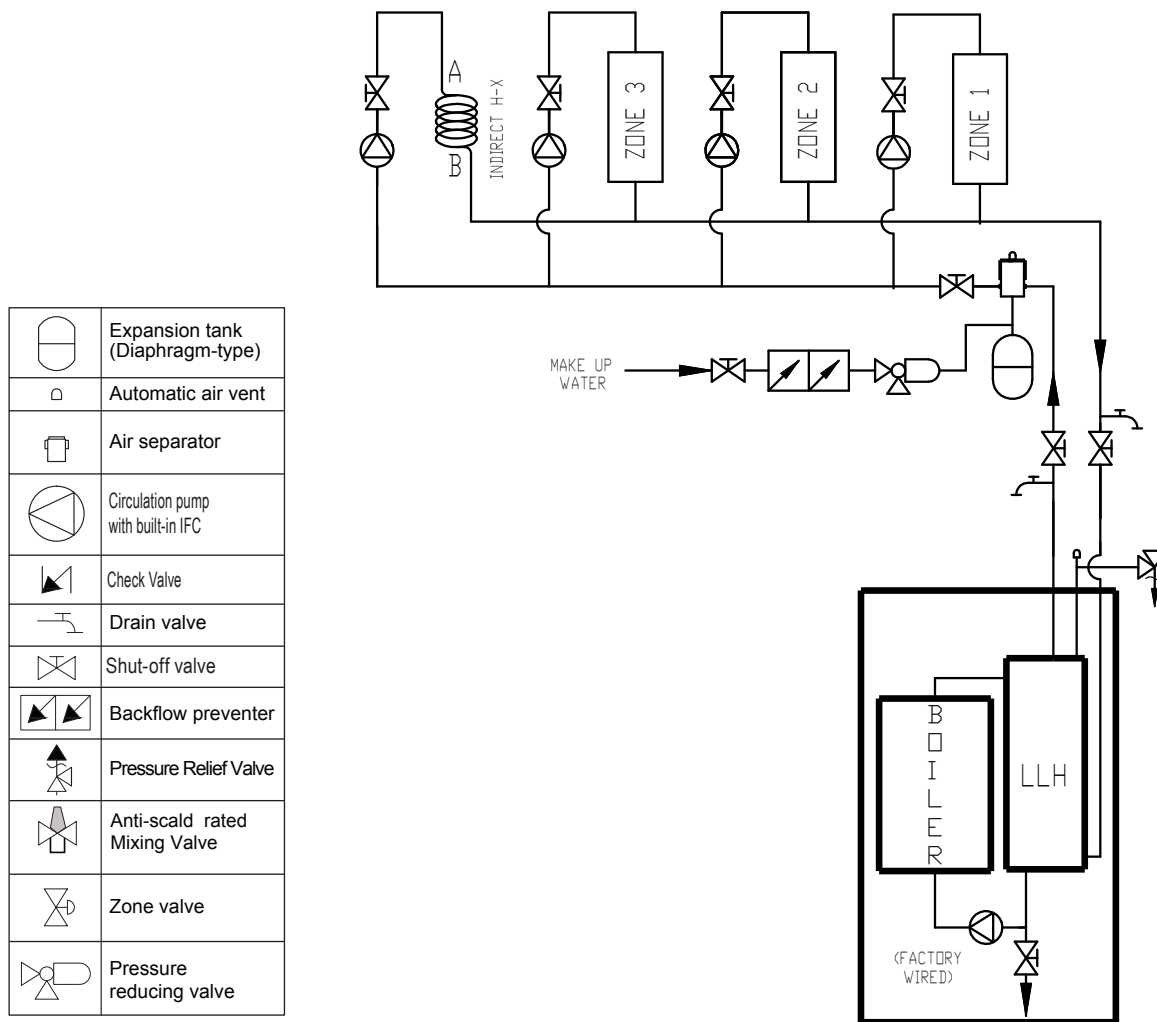
1. This piping diagram is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. The system return must be piped directly to the Boiler Return connection.
3. The system supply must be piped directly to the Boiler Supply connection.
4. The heat exchanger in the Indirect Tank (by others) shall be piped as a separate zone. The power for the pump (by others) and its control is provided by the Boiler Control. Hot water priority is also provided by the Boiler Control.
5. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
6. Manufacturer strongly recommends the use of an anti-scald mixing valve at the hot water outlet of the Indirect Tank to reduce the potential for scalding. Check with local codes.
7. The tank aquastat or DHW sensor connects back to the DHW sensor terminals. Use parameter 39 in Section 5.7 to define aquastat or DHW sensor setting to the boiler.
8. Connect the Outdoor Sensor (OS) for outdoor reset operation to the O/S terminals.

Wiring with zone valves and indirect DHW tank pump



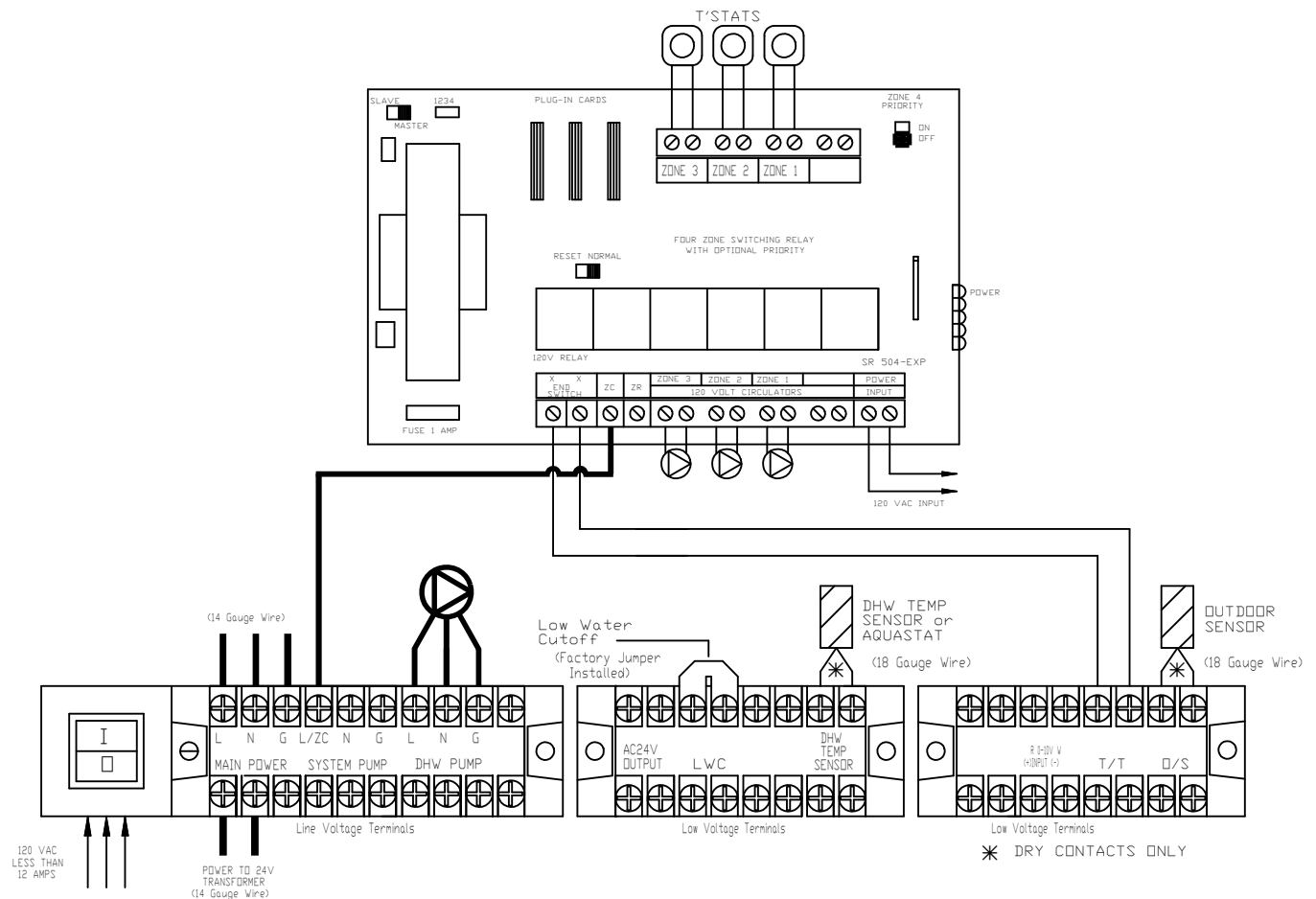
1. Taco ZVC 404 used for illustrative purposes; other, similar zone valve control panels can be used. The control panel does not require Hot Water Priority and it should be switched off on the ZVC 404 because it is provided by the FTHF boiler control.
2. Connect the end switch of the zone valve panel back to the T/T terminals on the FTHF boiler.
3. Connect the system pump for the zone valves to the System Pump terminals.
4. Connect the DHW pump for the Indirect Tank to the DHW Pump terminals.
5. Connect the outdoor sensor (OS) to the OS terminals for outdoor reset operation.
6. Do NOT bring 24 V back to the T/T terminals. Only a dry contact switch is permitted.
7. The tank aquastat or DHW sensor connects back to the DHW sensor terminals. Use parameter 39 in Section 5.7 to define aquastat or DHW sensor setting to the boiler.

4.16.6 Zoning with pumps and indirect DHW tank pump.



1. This piping diagram is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. The minimum size piping to the Indirect Tank heat exchanger is $\frac{3}{4}$ " inside diameter.
3. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
4. The system return must be piped directly to the Boiler Return connection.
5. The system supply must be piped directly to the Boiler Supply connection.
6. The heat exchanger in the Indirect Tank shall be piped as a separate zone. Power the pump for the indirect tank from the DHW tank terminals. The (dry contact) aquastat or DHW sensor connects back to the DHW sensor terminals of the boiler.
7. Manufacturer strongly recommends the use of an anti-scald mixing valve at the hot water outlet of the Indirect Tank to reduce the potential for scalding. Check with local codes.

Wiring with multiple pumps and indirect DHW tank pump.



1. The traditional Taco SR-504 zone switching relay panel was used for illustrative purposes; other, similar zone relay panels may be used. The relay panel does not require hot water priority because it is provided by the FTTHF boiler control. Modern zone switching relay panels with 2 end switches can be wired directly to the T-T and DHW terminals without a ZC connection. End switches must be dry contacts only. Refer to item 7 below for proper set-up of parameter P39.
2. Connect the end switch from the relay panel back to the T/T terminals on the FTTHF boiler.
3. Do not bring 24 V back to the T/T terminals. Only a dry contact switch is permitted.
4. Connect the ZC terminal from the relay panel back to the L/ZC terminal on the FTTHF boiler. Make sure to remove the factory jumper from ZC to ZR on relay panel.
5. Connect all heating zone circulators to the relay panel as indicated.
6. Connect the outdoor sensor (OS) to the OS terminals on the boiler.
7. The tank aquastat or DHW sensor connects back to the DHW sensor terminals. Use parameter 39 in Section 5.7 to define aquastat or DHW sensor setting to the boiler.

4.17 Pressure Relief Valve

- External pressure relief valves must be installed. Observe the following. Failure to comply with the guidelines on installing the pressure relief valve and discharge piping can result in personal injury, death or substantial property damage.

WARNING

Do not operate this appliance before the pressure relief valve supplied is installed with sufficient relieving capacity in accordance with the ASME Rating Plate on the boiler.

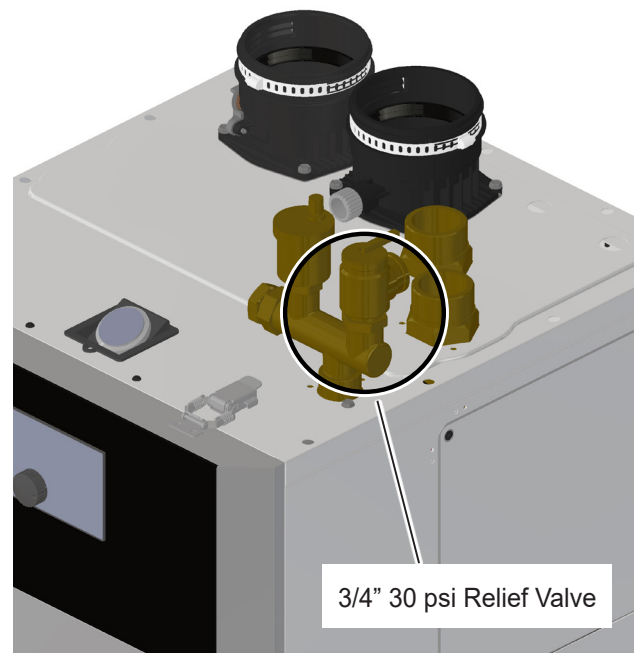
- A special brass adaptor, air eliminator and relief valve are supplied in an accessory box. Install this fitting on the right front connection as shown here.
- This safety relief valve (30 psi) is shipped loose for field installation.
- Install the air eliminator and relief valve as shown.
- For safety, the relief valve(s) must be installed into its designated location and not be removed or plugged. Failure to comply with the guidelines on installing the pressure relief valves and discharge piping can result in personal injury, death or substantial property damage.
- Direct the discharge piping of the pressure relief valve to a nearby floor drain so that hot water will not splash on anyone or any nearby equipment. Attach the hard piped copper discharge line to the pressure relief valve and run the end of the line within 6-12" (150 - 300mm) of the floor.
- A separate external LWCO can be installed by removing the 3/4" cap on the brass adaptor to install the LWCO.

WARNING

DO NOT install a CH pipe line relief valve with a pressure higher than 30 psi. This is the maximum allowable relief valve setting for the boiler.

- Test the operation of the valve after filling and pressurizing 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. Ensure that the discharge capacity of the pressure relief valve is equal to or greater than the maximum input rating of the boiler.

- Ensure that the maximum BTU/H rating on the pressure relief valve is equal to or greater than the maximum input BTU/H rating of the boiler.
- Pressure Relief Valve must be installed on the provided CH Pressure Relief valve tapping at the top of the Combi (CH supply line: maximum 30 psi). No other valves should be placed between the pressure relief valve and the appliance.
- This appliance has a high-temperature shut off switch built in as a standard safety feature. Therefore a "pressure only" relief valve is required.



4.18 Disposal of Condensate

- High efficiency gas condensing boilers create condensation when operating. Condensation is acidic with a pH ranging from 4 to 5.
- Attach the supplied condensate drain hose to the installed condensate trap. Make sure to attach the 1/8" air vent tube and secure this 6" long hose to a bracket so it will not spill condensate. Follow your local code with regards to the disposal of condensation.

One of 3 disposal methods must be followed

- 1. to a floor drain**
- 2. Combination neutralizer and condensate pump kit (optional kit available from manufacturer)**
- 3. to a condensate pump (field supplied)**

- If a neutralizer is installed, periodic replacement of the lime stone (or neutralizing agent) will be required. The rate of depletion of the lime stone varies upon usage of the boiler. During the first year of operation, please check the neutralizer every few months for depletion.
- Apply only corrosion-resistant materials for the condensate drain lines such as 1/2" PVC, CPVC, Polypropylene pipe or included plastic hose.
- In case of a closet installation, a combination neutralizer/pump (FT3007 kit) can be installed by removing the lower left access panel, an electrical outlet (Max amp rating: 2 Amp) is provided to power the condensate pump.
- Overall dimensions can not exceed 15-7/8" (L) x 5-7/16" (W) x 6-3/4" (H) in order to fit inside the boiler cabinet.

- If desired, a discharge 1/4" or 3/8" can be routed by removing yellow cap from the top right rear corner and routing the hose down to the condensate pump.
- Knock-out provisions are supplied in the lower left, rear or right hand side panels to rout the condensate to a nearby floor drain or externally placed condensate pump.
- Cut a small opening in the plastic grommet and pull the discharge hose through the opening for strain relief.
- When placing the FT3007 kit or other suitable condensate pump/ neutralizer combination inside the cabinet, it may be necessary with a small clip (not provided) to secure the condensate hose coming from the trap to this cover. One can also use the soft plastic insert, shorten the condensate drain hose and carefully "thread" the hose into this insert and place it into its designation location of the FT3007 kit.

⚠ NOTICE

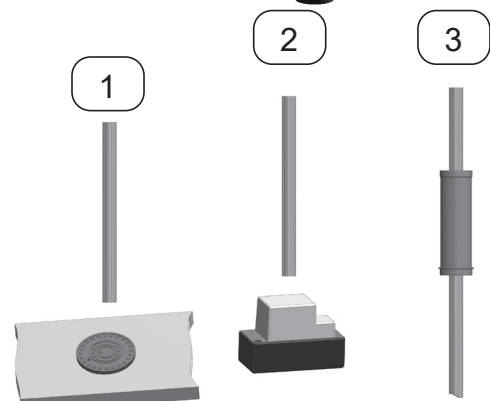
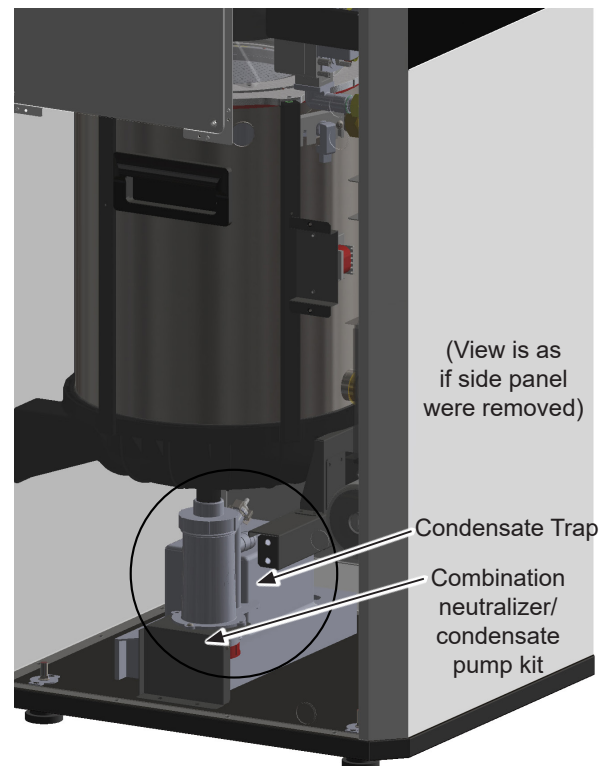
Category II & IV boilers must be installed with a means provided for the drainage of condensate.

⚠ AVIS

les chaudières de catégories II et IV doivent être installées avec un moyen de drainage du condensat.

⚠ CAUTION

Condensate is mildly acidic (pH=5), and may harm some floor drains and/or pipes, particularly those that are metal. Ensure that the drain, drainpipe, and anything that will come in contact with the condensate can withstand the acidity, or neutralize the condensate before disposal. **Damage caused by failure to install a neutralizer kit or to adequately treat condensate will not be the manufacturer's responsibility.**

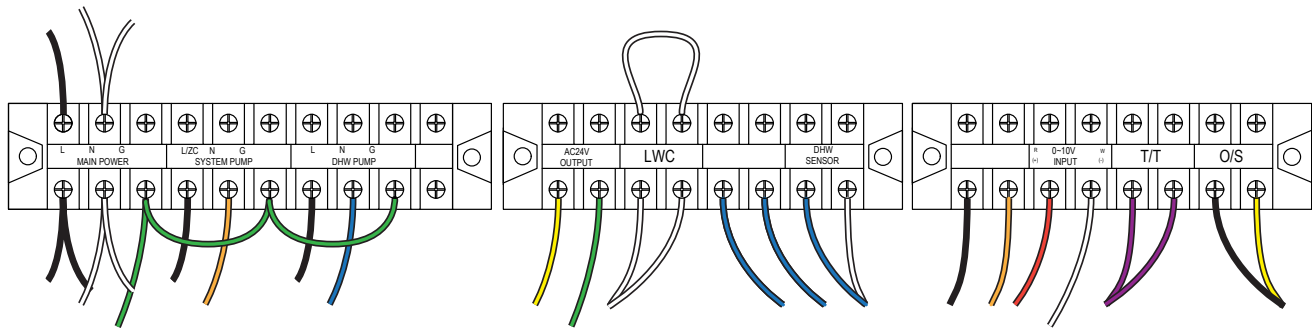


Various condensate disposal methods

4.19 Electrical Wiring Connections

Field Wiring: Top of terminals

Install wiring as shown below.



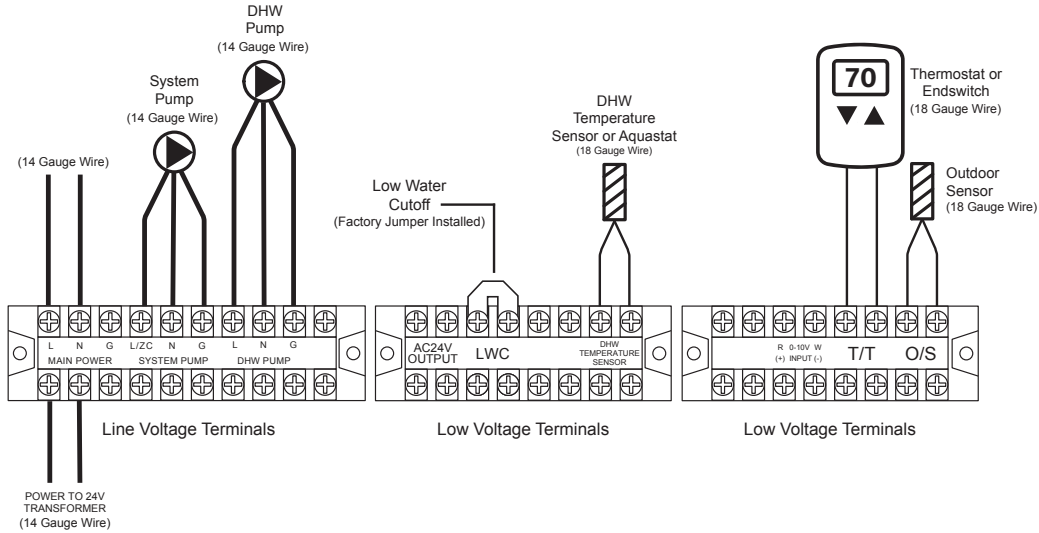
⚠ WARNING

Install wiring and electrically ground boiler in accordance with authority having jurisdiction or, in the absence of such requirements, follow the National Electrical Code, NFPA 70, and/or CSA C22.1 Electrical Code-Part 1 in Canada.

ELECTRICAL SHOCK HAZARD — For your 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 can cause severe personal injury or death.

- This appliance must be electrically grounded. Ensure the electrical receptacle that the combination boiler will be plugged into, is properly grounded; if wiring directly.
- It is permissible to remove the electrical plug and hard wire the appliance directly into appropriately sized electrical wiring, properly grounded.
- Do not attach the ground wire to either the gas or the water piping as plastic pipe or dielectric unions may isolate the Combination boiler electrically.
- The wiring diagrams contained in this manual are for reference purposes only.
- Refer to these diagrams and diagrams from external controls used with this appliance. Read, understand, and follow all wiring instructions.
- Do not disconnect the power supply when the unit is in normal operation. Damage caused by freezing is not covered under the warranty.
- Manual(Rocker) switch maximum allowable current for each circulator is 1.6 amps at 125VAC.
(Housing : Nylon #66 UL 94V-2 , Rocker : Nylon #66 UL 94V-2, Terminal : Copper Alloy)
- Terminal block (External power connector) : DFT-20A-10P (20 amps at 300VAC)

4.19 Electrical Wiring Connections (continued)

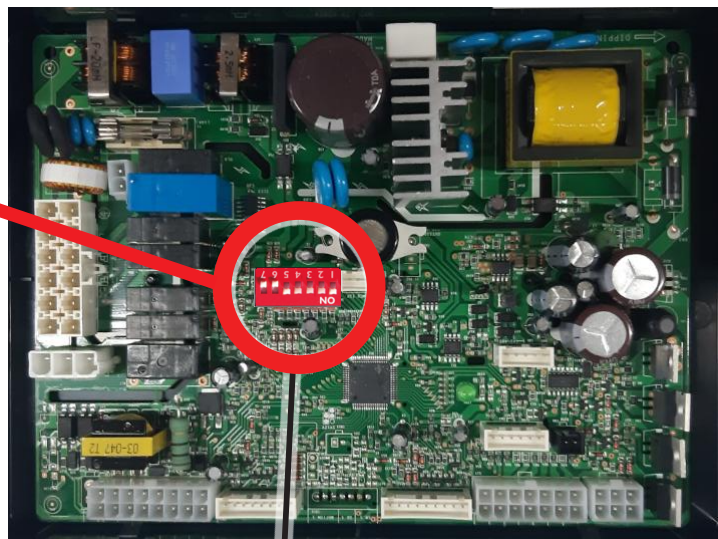


4.20 Dip Switches

Shown is a Model 199 Natural Gas with 3" Venting.



7*	6*	5	4	3	2	1
OFF	OFF	LP Gas	2" Vent			
Low Fire	High Fire	Natural Gas	3" Vent	FACTORY SET		



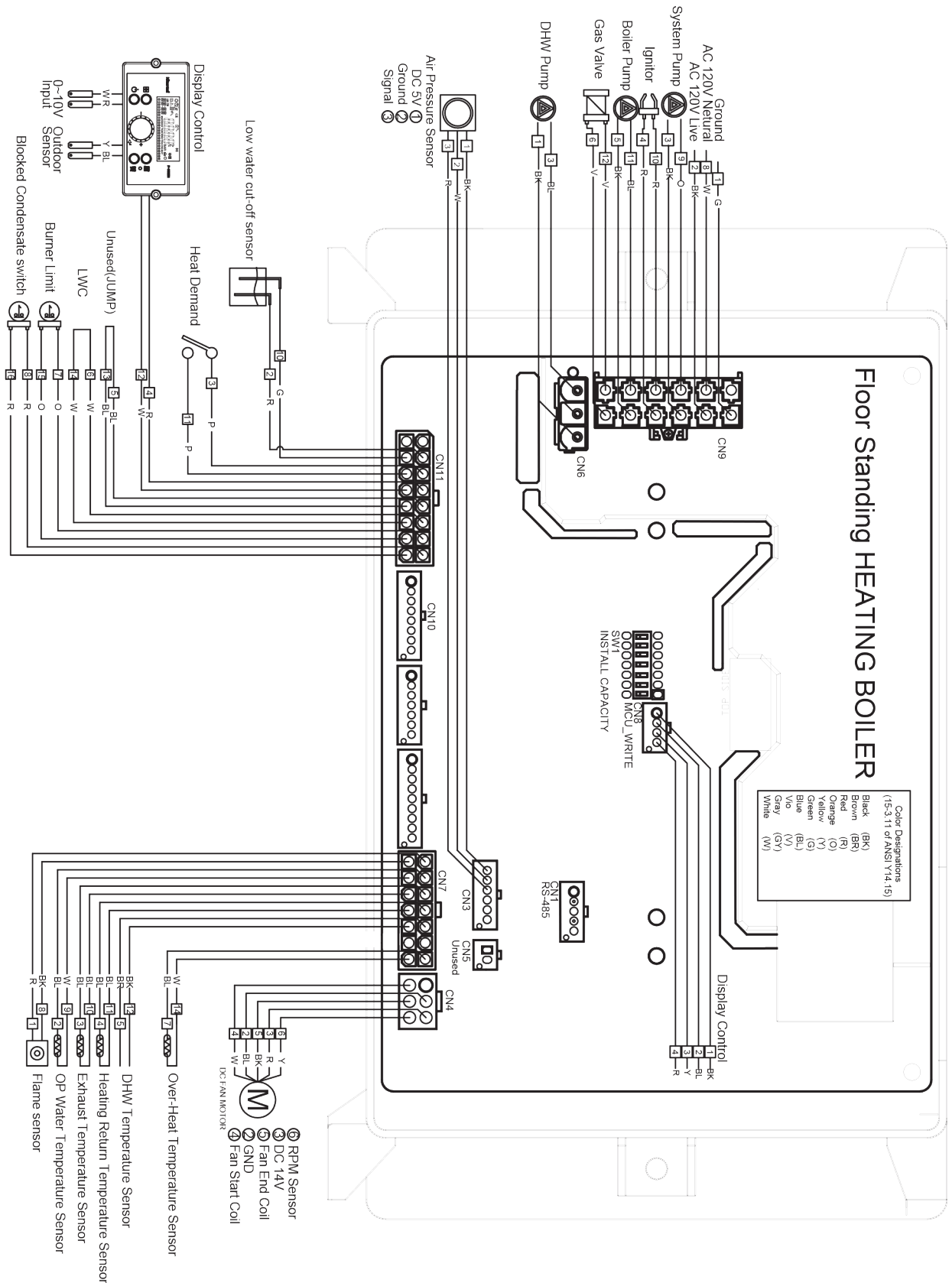
*Dip Switches #7 and #6 are Maximum and Minimum fire test Switches which are used only when setting up combustion (See Section 4.13). These switches should only be in the ON position during either High or Low fire testing. When finished testing, ensure both of these switches are in the OFF position.

Dip Switches #1, 2 and 3 are Set at the factory and should not need adjusting. For reference the correct positions of these three switches are as follows: Model FTHF199: All three dipswitches should be in the "down"/ ON position (As shown above)

System Control Setting

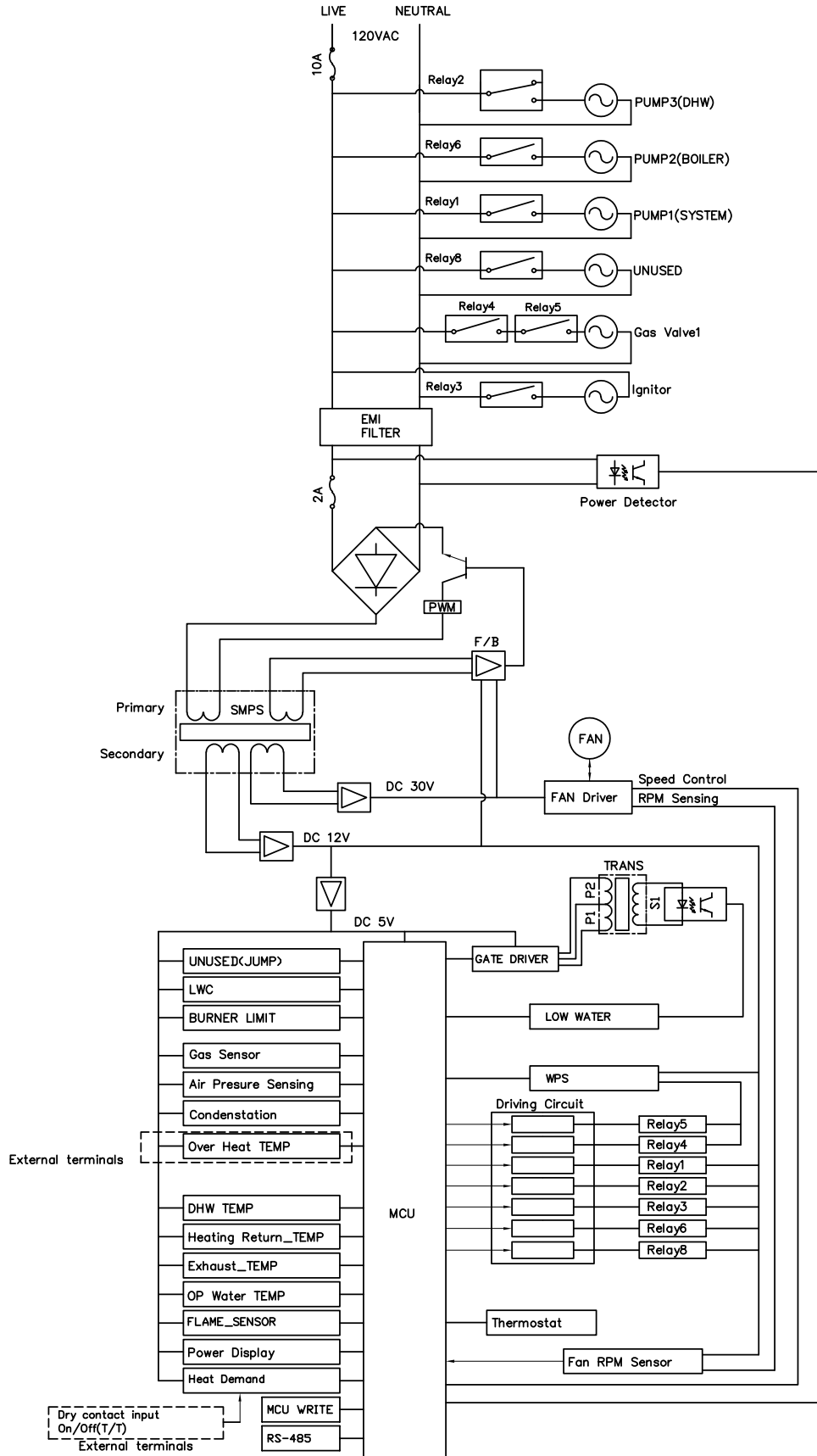
Maximum flame detecting voltage	2.4V
Pre-purge time (Tp)	Maximum 10s, minimum 1s
Safety Time (igniting time) (Ts)	3s
Igniting interval time	10s
Post-purge time (Tip)	120S (1st : 60s + 2nd 60s)
Over-heating 1,2,3 protection detection time	<3s
Pump1 post circulating time (T1pv)	60s
Pump2 post circulating time (T1pv)	60s
High & Low Water Level detection time	<6s
High & Low Water Level Recover time	<6s

4.21 Control Board, Electrical Diagram



Control Board

4.22 Ladder Diagram



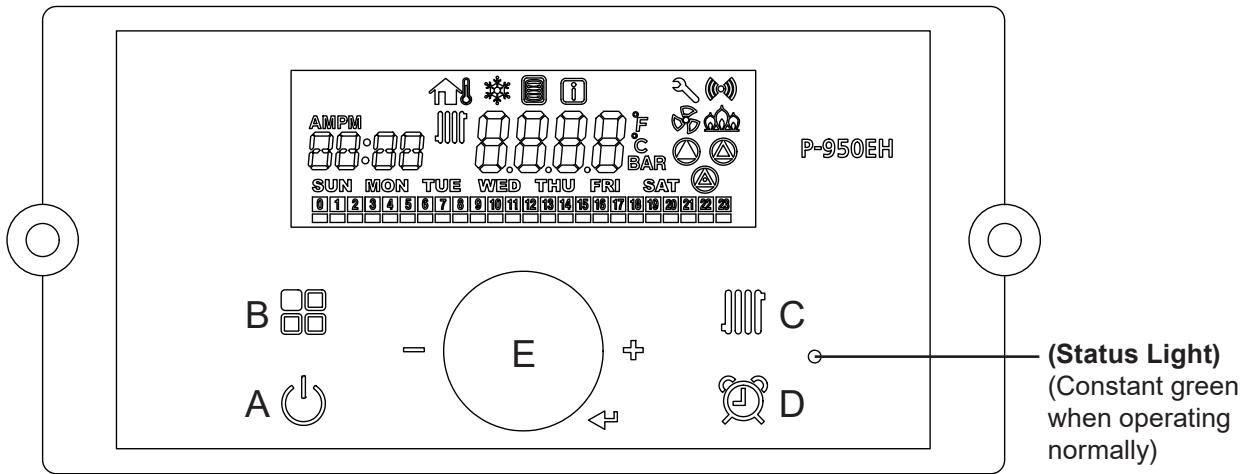
4.23 Electrical Connections, (table)

Connector			Description	HT SELV
#, Location, Type	PIN	Label		
CN9 65001WS-12	1	-	GROUND	HT (120V~)
	2	L	Power Supply Line	HT (120V~)
	3	CP1	Boiler Pump	HT (120V~)
	4	IT	Igniter	HT (120V~)
	5	Heating/CP2	System Pump	HT (120V~)
	6	GV	Gas Valve	HT (120V~)
	7	-	-	-
	8	N	Power Supply Neutral	HT (120V~)
	9-12	— N —	AC Power COM Line	HT (120V~)
CN6 LW6A4-03	1	CP3	DHW Pump	HT (120V~)
	3		HT (120V~)	
CN1 SMW250-5D	1	RS-485	RS485 (+)	SELV (5V)
	2		RS485 (-)	SELV (5V)
	3		GND	
	4		RS485 (+)	SELV (5V)
	5		RS485 (-)	SELV (5V)
CN4 LWD1140-06D	1	FAN	Not Used	-
	2		GND	SELV (14V)
	3		VDD	SELV (14V)
	4		Fan power(start coil)	SELV
	5		Fan power(end coil)	(8-26 Vac)
	6		Fan speed feedback signal	SELV (14V)
CN8 SMW250-04D	1	MCU ISP	GND	SELV (5V)
	2		ISP /Reset port	SELV (5V)
	3		ISP TOOL0 Data port	SELV (5V)
	4		VCC	SELV (5V)
CN11 LWD1140-16	1	HWL	Not Used	SELV (12V~)
	8			
	2	LWC	Low Water Level Leakage Sensor	SELV (12V~)
	10			
	3	HD	Heating Demand (T/T)	SELV (5V)
	11			
	4	TH	Connect to the Display Control(Thermostat)	SELV (14V)
	12			
	5	UNUSED	Jump	SELV (14V)
	13			
	6	LWC	External LWC	SELV (14V)
	14			
	7	BL	Burner Limit	SELV (14V)
	15			
	8	HL	Condensate Blocked Switch	SELV (14V)
	16			

Electrical Connections , (table) (continued)

Connector			Description	HT SELV
#, Location, Type	PIN	Label		
CN7 LWD1140-14	1	F.S	Flame Detect Sensor	SELV (5V)
	8			
	2	OP.S	Operating water temperature sensor	SELV (5V)
	9			
	3	DH.S	Venting (exhaust) temperature sensor	SELV (5V)
	10			
	4	I.S	System return temperature sensor	SELV (5V)
	11			
	5	BG.S	DHW Temperature Sensor	SELV (5V)
	12			
	6	Not Used	Not Used	
	13			
	7	SP.S	Over-Heat temperature sensor	SELV (5V)
	14			
CN10 SMW250-08D	1	Not Used		
	2	Not Used		
	3	Not Used		
	4	Not Used		
	5	Not Used		
	6	Not Used		
	7	Not Used		
	8	Not Used		
CN3 SMW250-06D	1	APS SENSOR	VCC	SELV (5V)
	2		GND	SELV (5V)
	3		Voltage Input	SELV (5V)
	4	Not Used		
	5			
	6			

5.1 Control Dial and Buttons



The Control Display

The Control Display has a Control Dial (E), 4 Buttons (A,B,C,D), and a Liquid Crystal Display (with 72 back lit segments). This section of this manual gives instruction on how to navigate into the many functions of the FT and to change temperature set points, set system variables and controller parameters.

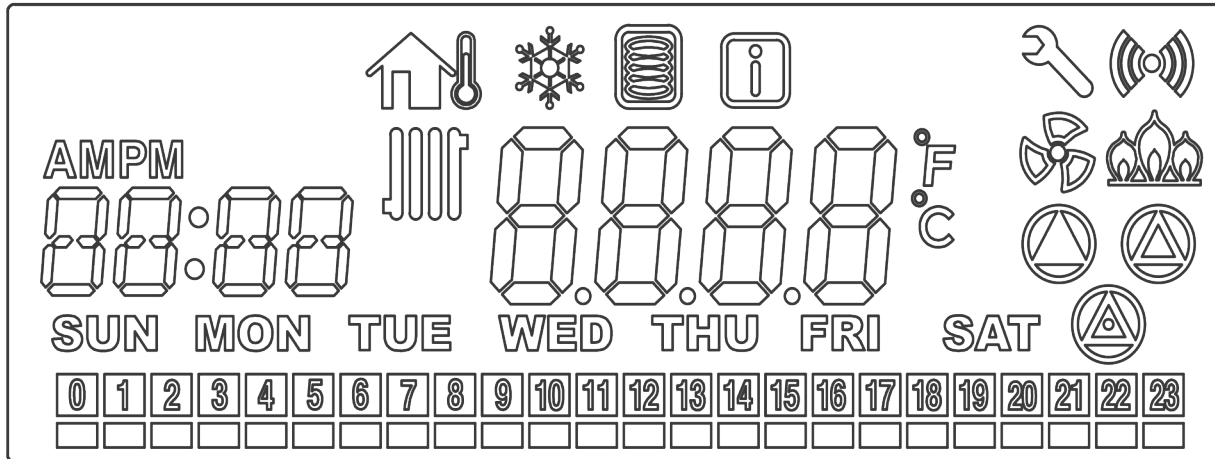
Buttons			Functionality	
			PRESS (Tap)	PRESS and HOLD (5 seconds)
A		Display Power	Turns control Display ON/OFF	
B		Modes	Tap to return to menu	(If Display Power was on) Status Display Mode (If Display Power was off) Installer Mode
C		Heating Water	CH set point change mode (Maximum 82°C (180°F))	
D		Time/Date Set	No Change	To SET: Year/Month/Week/Day/Time/Min
E		Scroll/Select	Menu select or value up(+) /down(-) or setting dial	

- Temperature Specifications
 - Operating ambient Temperature Range : -10 to 60°C.
 - Operating Relative Humidity up to : 90% at 40°C.
 - Shipping & Storage Temperature Range of : -20 to 80°C.

⚠ WARNING

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

5.2 LCD Overview




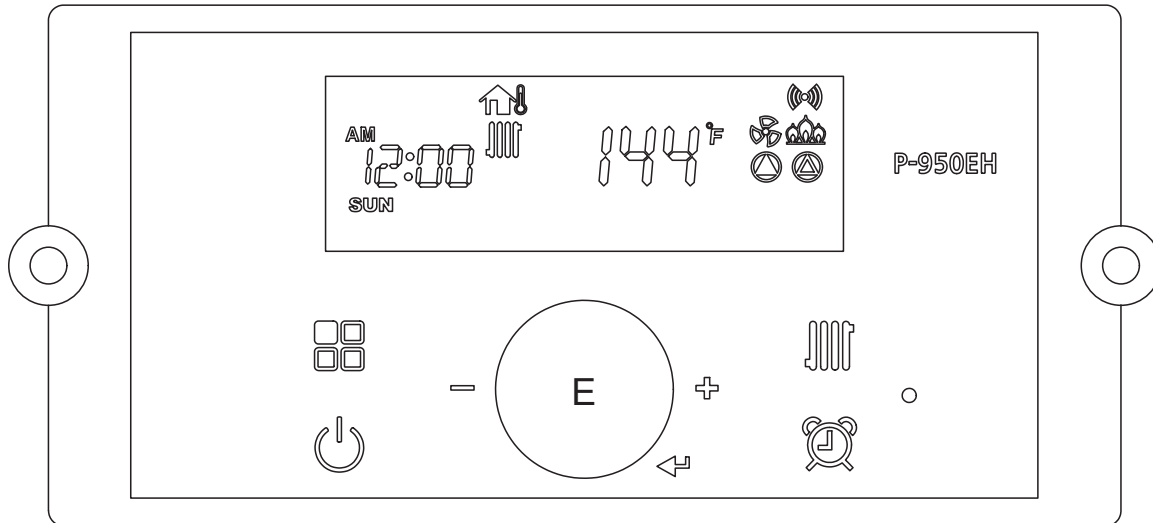
Symbol	Name	Description
	Service Reminder mode	Service Reminder mode indication
	Outside Temperature Mode	Outside Temp setting indication
	Anti-freeze mode	Anti-freeze mode indication
	Storage mode	Storage mode indication
	Information mode	Information mode indication
	Communication state	Communication state indication
	Time setting mode	Time /Dispaly/Install mode indication
	Fan operating mode	Fan operating mode indication
	Flame signal	Flame Signal indication
	CH pump mode	CH pump mode indication
	Storage pump mode	Storage pump mode indication
	Internal boiler pump	Internal Boiler pump mode indication
	Celsius mode	Indicated as Celsius temperature
	Fahrenheit mode	Indicated as Fahrenheit temperature
	Heat demand mode	Heat demand mode indication
	DAY mode	Current day mode indication
	Cascade System connecting mode	Cascade System connecting mode indication
	Cascade System operating mode	Cascade System operating mode indication




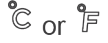






The LCD will illuminate when a user action is detected (a button is pressed) and will turn back off after 20 seconds.

5.3 Operating Mode

■ Operating Mode

After the Power is turned on, and/or the Control Display is turned on , the Control Display will go through a 'Start Up' checklist and briefly show a sequence of diagnostic codes before entering into the 'Operating Mode'. It will then display the following information.



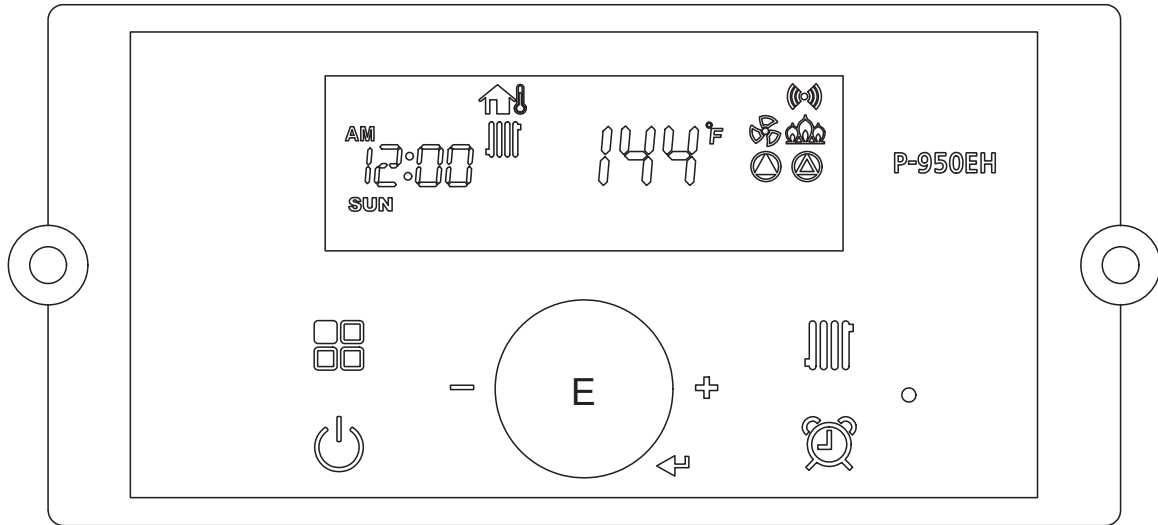
Indicate	Indicator
Current Operating Temperature Set point	
If the Fan is operating	
If a flame is detected	
Celsius or Fahrenheit	
Date and Time indicator	
If Outside Temperature Sensor is operating	
If there is a Demand for Central Heat (CH)	
If CH pump state is operating	
If Internal boiler pump is operating	
If Communication state is activated	

The Control Display can operate through user and service modes that have specific LCD output and dedicated controls:

- Set point change mode • Lock mode • Error mode • Status display mode
- Outside Temperature mode • Installer mode


* Control Display will not allow changing of button in case of lock mode activated.


5.4 Setting the Clock



The P-950EH Control Display does NOT have a daily timer or programmable thermostat.

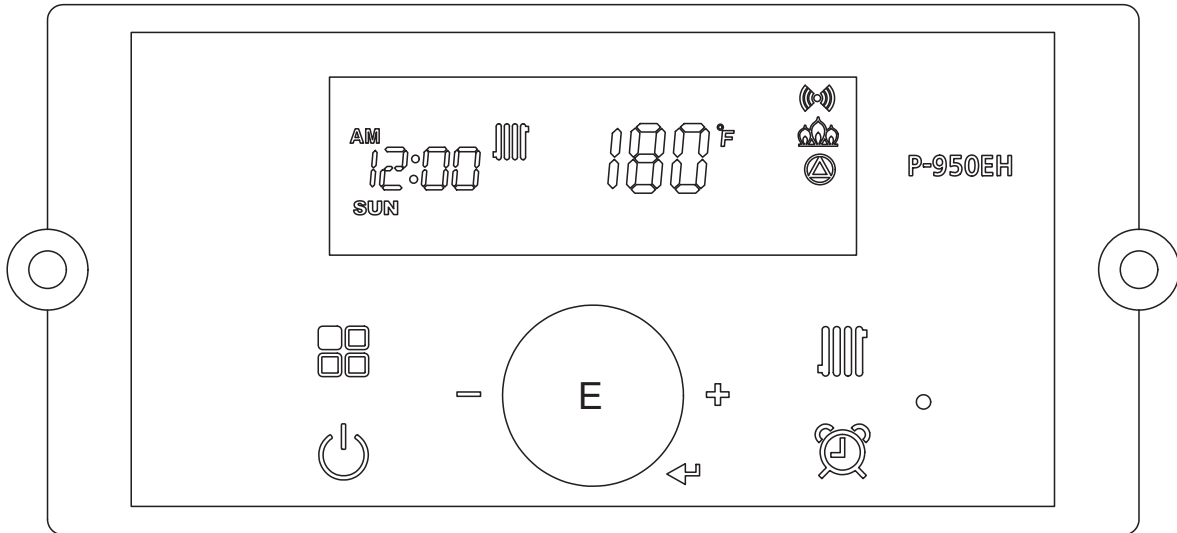
Setting the Clock


- Press and hold the  'Clock button' for about 5 seconds. Set the 'Year' by turning the dial **E**. And then, press the dial **E** to Save.
- Set the '**MON**' (Month) by turning the dial **E** to the desired month number. Then press the dial **E** to Save.
- Set the '**DATE**' (1-31, Day of the Month) by turning the dial **E**. Then press the dial **E** to Save.
- Set the '**HOUR**' (1-24, Hour of the Day) by turning the dial **E**. Then press the dial **E** to Save.
- Set the '**MIN**' (1-60, Minute of the Hour) by turning the dial **E**. Then press the dial **E** to Save.
- Set the '**Day**' (Sun - Sat) by turning the dial **E**. Then press the dial **E** to Save.

To Exit at any time, tap the  button.

5.5 CH Set Point Change Mode






- CH set point Change Mode (This mode is only functional when the outdoor sensor (O/S) is not connected.)
- In accordance with the United States Energy Policy and Conservation Act, this boiler is equipped with outdoor reset capability, a feature that saves energy by reducing boiler water temperature as heating load decreases Refer to Section 5.9 regarding the O/S details.



To change CH Set point, press the C  button. The CH Icon and current CH Set point will flash.

Turn the E dial clockwise to increase, and counterclockwise to decrease CH set point, until desired temperature is reached.

Press E dial to save changes and to Exit.

Indicate	Indicator
Current CH Temperature Set point	
Celsius or Fahrenheit	°C or °F
If Communication state is activated	
If flame is detected	
Date and Time indicator	AM PM 00:00
If CH pump is operating	
If there currently a Demand for Central Heat (CH)	


Default CH set point is 140 F (60 C).

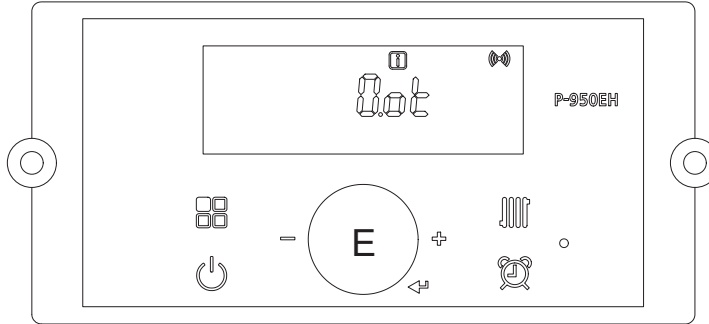
CH set point range is 130°F~180°F (54°C~82.0°C)

This range can be adjusted as per P6 and P7 in Section 5.7.

5.6 Status Display Mode

To view any Status Parameter,

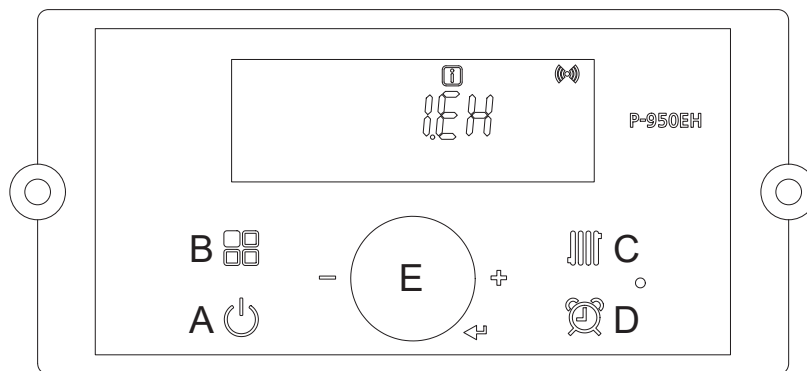
Press and Hold Button B  to get into the Status Display Mode. Rotate Dial E until you find the Parameter that you wish to view. Tap Dial E to enter that Parameter as required. Dial E to save and to exit the Status Information Menu. To go back to the Operation Screen Press button B.



Digital Display	Status Display Parameter	Description
O: ot	Outdoor temperature	Current outdoor sensor temperature
A: In	0-10 V display	Current voltage of (0-10V input)
b: tt	CH target temperature in cascade system	Current CH target temperature or Current System target temperature in a cascade system
C: It	CH return water temperature	Current CH return water temperature
d: Fr	FAN speed (rpm)	Current FAN speed (RPM)
E: oP	CH supply temperature (Operating temperature)	Current heating temperature
F: Eh	Exhaust gas temperature	Current exhaust gas temperature
H: dH	Indirect DHW tank temperature * If temperature sensor is not connected then it will display with 0°F (0°C).	Current DHW tank temperature
I: oH	Overheat water temperature	Current Overheat water temperature
L: rt	Burner Operation Time	1: PH Time for supply power Unit : 1000hour
		2: rh Time for burner operation Unit : 1hour
		3: rH Time for burner operation Unit : 1,000hour
		4: It Cycle for ignition Cycle : 10 times the displayed unit
		5: IH Cycle for ignition Cycle : 10,000 times the displayed unit
M: CC	SELF	Percentage of self units running. Percentage of self units running.
	ALL	Capacity for all operating cascade units Percentage of all 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 for individual boilers Percentage of each cascade units running. Ex. F1, F2,
N: St	System Temperature (cascade mode) * If system temperature sensor is not connected then it will display with 32°F.	Current System Temperature (cascade mode)

5.7 Installer Mode


These changes are to be made only by a qualified technician.



⚠ WARNING

For low temperature heating applications, adjust P6 to desired value. For cascade applications, adjust P31 to desired water temperature. Call Technical services for assistance in changing settings.

To change any of the Installer Parameters, Start by turning **OFF** the Power  (Button A) to the Display Control.

Then, with the power OFF, Press and HOLD (more than 5 seconds) the Button B  to get into the Installer Mode.

Rotate Dial E until you find the Installer Parameter (full list on facing page) that you wish to change. Tap Dial E to enter that Parameter.

Adjust to the setting that you require using Dial E and then press (tap) Dial E to save and to Exit.

Finish by pressing button B  and then turning the power back on to the control (Button A).

Index Numbers	Parameter	Description
1: EH	Error history up to 10	Check last 10 error codes (E0 - E9)
2: cE	Delete Error history	Select "ON" to delete error code history Range: ON or OFF, Default OFF
3: In	System initialize	Select "ON" to reset to factory setting, Default OFF
4: OH	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 at least 9°F above the minimum outdoor temperature. Range: (Minimum Outdoor Temperature + 9°F) to 110°F , Default 68°F
5: OL	Minimum Outdoor Temperature	Sets the minimum outdoor design temperature for the system. Minimum outdoor temperature must be set at least 9°F below the maximum outdoor temperature. Range: -4°F to (Maximum Outdoor Temperature - 9°F), Default 30°F
6: cH	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, Default 180°F

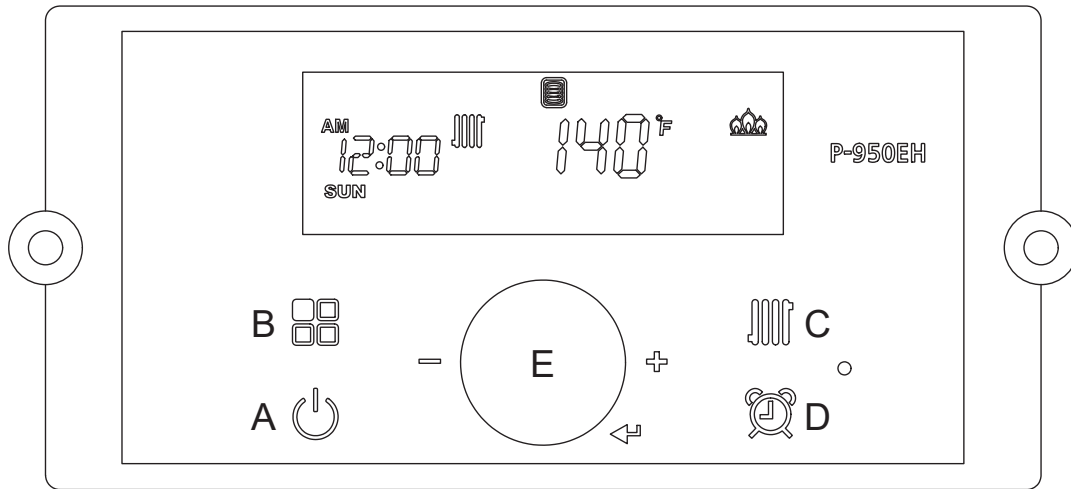
5.7 Installer Mode (continued)

Index Numbers	Parameter	Description
7: cL	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 130°F
8: OF	Warm Weather Shutdown	This warm weather temperature setting will shut down CH Mode Range : 50 °F- 110°F, Default 100°F
9: bt	Boost Function	This function boosts CH temperature to the maximum if set point is not reached within the set period of time. Range: 0 - 120 min, Default 0
10: bd	Boost Degree	The boiler will add this temperature to the boiler target set point based on outdoor reset curve. Range: 5-15°F Default: 10°F
11: bl	Boost Interval	The boiler will index the temperature based on time interval set on 11 bl. Range: 0-120 MIN Default: 20 MIN
12: FH	Maximum Fan speed	Adjusts Maximum Fan Speed Range: -30 to +30,Default 00
13: FL	Minimum Fan speed	Adjusts Minimum Fan Speed Range: -30 to +30,Default 00
14: dr	Reset burner runtime counter	Select ON to Initialize burner operation time Range: NO or YES,Default NO
15: dl	Reset ignition cycle counter	Select ON to Initialize ignition cycles Range: NO or YES,Default NO
16: Ft	CH Anti-Cycling time	This function delays burner operation during CH mode Range: 0 - 20 min, Default 1
17: bo	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 27°F, the appliance will turn on when CH water temperature falls below 153°F. Range: 5°F - 30°F, Default 15°F
18: cb	Heating capacity	Set Heating combustion rate Range: 50 - 100%, Default 100
19: db	DHW capacity	Set DHW combustion rate Range: 50 - 100% , Default 100
20:PE	Boiler pump & system pump post-purge time, T/T satisfied	Allows user to set boiler and system pump post-purge time once appliance CH setpoint and thermostat are satisfied. Range: 1 - 5 mins. Default: 1 min.
21: dH	Indirect Storage Tank Temperature Set Point	Sets Maximum Indirect storage tank Temperature Range:95 - 180°F , Default 120 °F
22: dd	Indirect Storage Tank Differential Set Point	DHW Differential Set Point Range: 5°F-30°F, Default 7 °F
23: Pr	DHW Pump Post Run Time	DHW Pump Post Run Time Range: 0-10 Min , Default 1 Min
24: dP	DHW Priority Timer	DHW Priority Timer Range: 0 – 60 Min , Default 30 Min
25: St	Boiler Supply Indirect Storage Tank Temperature	Boiler Supply Indirect Tank Temperature Range: 120 °F– 180 °F , Default 180 °F
26: FP	System Freeze Protection Mode	System Freeze Protection Mode. This mode should be turned OFF for snow melt application. NOTE: This mode should be ON during normal operation. Range: ON/OFF, Default: ON

Index Numbers		Parameter	Description
27: Cn		Cascade Number	Cascade Number Range: 0 (Master), 1(slave 1), ..., 19(slave 19) "29: CP" has to be set with the total number of units in the cascade before "28: Cn" can be set. Default 0
28: CP		Cascade Parameter	Number of units cascaded Range: 1- 20 , Default 1
29: Eh		Common Vent	Common Vent Range: ON / OFF, Default OFF
30:Cr	Auto	Automatic rotation	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.
	Cr:Ct	Cascade Rotation time	Cascade Rotation time Range: 0-240 Hours, Default 48 Hours
31: Ct		Cascade System temperature	Cascade System temperature: Range: 40 - 180 F, Default 180 F
32: Cd		Cascade System Temperature Differential (burner ON)	Cascade System Temperature Differential (burner ON) Range: 5°F-30°F, Default 10°F
33: HA		High Elevation Mode	High Elevation Mode (0-2, 2-5, 5-8, 8-10), Default: 0-2, (0-2: 0-2,000 ft, 2-5: 2,000-5,000 ft etc)
34:AP	AP:cP	Internal CH Pump, CH Pump and DHW Indirect Pump Test Mode	This function sets the time to run both the Internal CH and Internal DHW Storage pumps to purge air from the system. Range: 1 – 30 minutes,Default 5
	P1:oF or P1:on	Internal CH Pump and CH Pump Test Mode	Turn this function on to activate Internal CH and CH pump testing. Only works in installation mode. Turns off when in normal mode. Default OFF
	P2:oF or P2:on	Internal CH Pump and DHW Indirect Pump Test Mode	Turn this function on to activate Internal CH and DHW Indirect pump testing. Only works in installation mode. Turns off when in normal mode. Default OFF
35: SS	SS:Sd	Allows the user to set the year of next service reminder	Allows the user to set the year of next service reminder XX / XX / XXXX (MONTH / DAY / YEAR)
	SS: br	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 (0: OFF, 1~9000Hours) , Default 0
36: UC	FAH(°F)	Allows the user to change the unit	Allows the user to change the unit Range: °F or °C Default FAH
	CEL(°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.
38: dM	OFF	DHW Step Modulation	Default: OFF (Selection: OFF or ON).
39: SA	AquaA	Select Aquastat (contact) Type	This mode is aquastat (contact) type. Default Aqua
	SEnS	Select DHW NTC Sensor Type	This mode is NTC sensor type.

5.8 Storage Mode

- Storage Mode / Indirect Water Heater







To change Storage Mode Temp, First turn OFF the power to the Control Display. Then Press and Hold Button B  to get into the Installer Mode.

Rotate Dial E until you find 21:dH Tap Dial E to enter Storage Mode. Storage Mode indicates that the boiler is heating the water held in an indirect water heater. When Storage Mode is active, the display will appear as shown.

Turn the E dial clockwise to increase, and counterclockwise to decrease setting.

Press E dial to save changes and to Exit.

Indicate	Indicator
Current CH set point of temperature	
Celsius or Fahrenheit	°C or °F
If flame detected	
Storage mode indication	
If there is a Demand for Central Heat (CH)	


NOTE: If using an Aquastat on the indirect tank, the stored hot water temperature is controlled by the Aquastat.

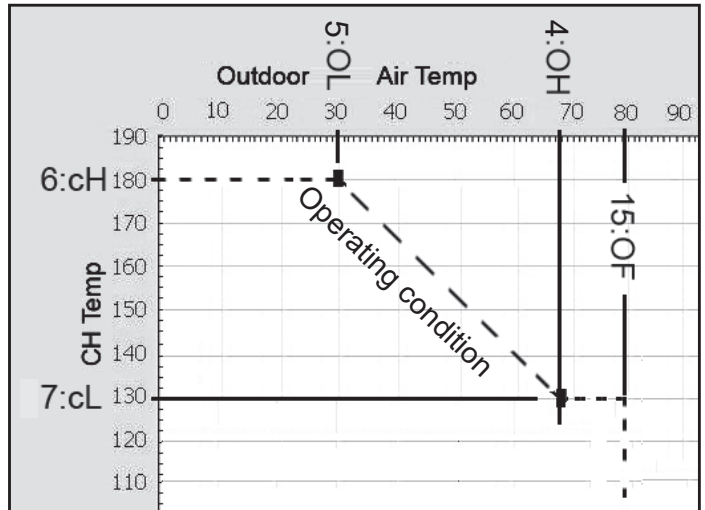
5.9 Outdoor Reset Adjustment

Outdoor Reset varies the control set point based on the outdoor temperature. The reset function works as shown in Figure 'CH Outdoor Reset'. When the outdoor air temperature reaches **4:OH** "high outdoor temperature set point", the control point setting is adjusted to **7:cL** "low boiler temperature set point". When the outdoor air temperature reaches **5:OL** "low outdoor temperature set point" the control set point is adjusted to **6:cH** "high boiler temperature".

Default warm weather shutdown temperature is 100°F (38 C)

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

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



Outdoor Reset

Note: In this example, the Summer Mode (Warm Weather Shut-down) is set to 80°F

(Summer Mode)

Connect to terminal strip as outlined 4.17 Electrical Connections.

NOTE: 0 - 10VDC terminals may not be used for both outdoor reset and 0 - 10VDC temperature set point simultaneously.

5.10 External Set Point Temperature Control

A signal from a building management system may be connected to the appliance to enable remote control. This signal should be a 0-10 volt DC signal. When this input is enabled, a building control system can be used to control the set point temperature of the appliance.

The control interprets the 0-10 volt signal as follows; when the signal is between 0 and 1.5 volts, the appliance will be in standby mode, not firing.

When the signal rises above 1.5 volts, the appliance will ignite. As the signal continues to rise towards its maximum of 10 volts, the appliance will increase in set point temperature. Adjust **6:cH** and **7:cL** to set MIN and MAX boiler water temperatures respectively.

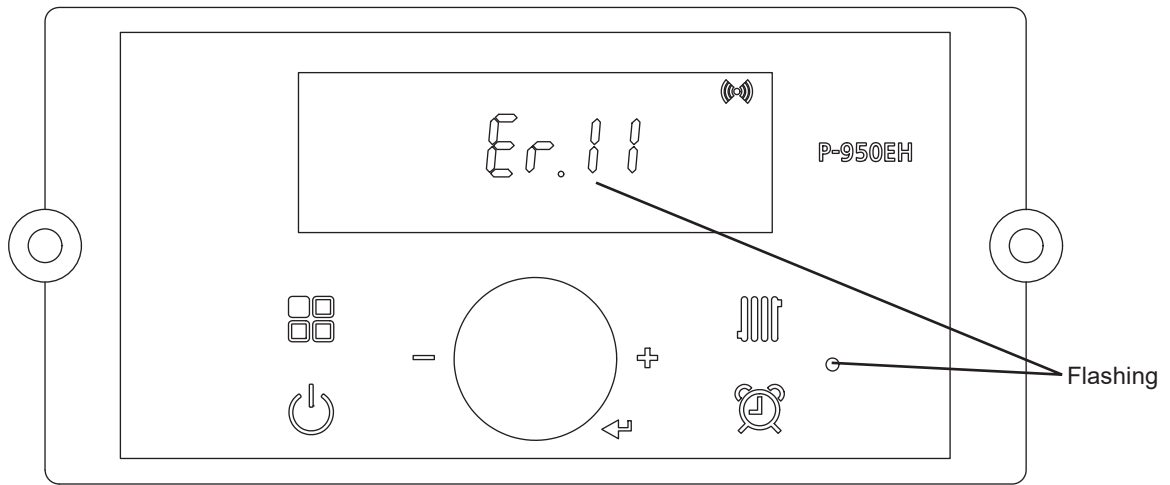
Connect a building management system or other auxiliary control signal to the terminals marked for this purpose on the appliance terminal block (shown in Piping Diagrams, this manual). Caution should be used to ensure that the 0-10 VOLT + connection does not become connected to ground.


Connect to terminal strip as outlined 4.17 Electrical Connections.


NOTE: 0 - 10VDC terminals may not be used for both outdoor reset and 0 - 10VDC temp set point simultaneously.

5.11 Error Mode

The Control Display will show the following information when an Error is presented.



Indicate	Indicator
Error ' Er : ' sign Segment	Er:11
Error Code	Er:11
If Communication state is activated	

NOTE: When communication between the Control Display and the main controller is lost, the  will not be displayed.

SECTION 6 Error Codes**6.1 Error Code Tables**

Error Code	Error Code Description	Possible Remedies	Recover methods
10	Combustion fault Flame has Extinguished 8 (Eight) Times	<p>Press the Power button to clear the Error Code. If Error happens again:</p> <ol style="list-style-type: none"> 1. Monitor the gas pressure to the appliance while in operation. Ensure pressure is between 3.5" to 10.5" WC (Nat. Gas) and 8" to 13" WC (Propane). 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 exhaust and intake terminations for blockages. Also verify that intake, intake boot, blower and burner housing is free of blockages and debris. 5. Assure that the flame is stable when lit. Confirm Flame stability by manually forcing the boiler into Low Fire (see section 4.20) - Burner should not cycle on and off in low fire. If burner cycles on/off during low fire operation adjust fuel/air mixture and confirm CO₂ values are within range for model and fuel type. 6. If the problem persists, contact technical support. 	Hard Lock
11	Ignition fault Ignition has Failed 10 (Ten) Times	<p>Press the Power button to clear the Error Code. If Error happens again:</p> <ol style="list-style-type: none"> 1. Monitor the gas pressure to the appliance while in operation. Ensure pressure is between 3.5" to 10.5" WC (Nat. Gas) and 8" to 13" WC (Propane). 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 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. Remove and inspect burner. If burner is damaged/blocked - replace burner 7. Assure that the flame is stable when lit. 8. If the problem persists, contact technical support. 	Hard Lock
16	Water temperature over-heating fault Operating Temperature Sensor detects Water Temperature Greater than 203°F (95°C)	<p>Press the Power button to clear the Error Code.</p> <p>If boiler is not piped Primary/Secondary it is likely the internal boiler pump is not able to move enough water thru heat exchanger. If Error happens again:</p> <ol style="list-style-type: none"> 1. Check if dip switch Max 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 appliance. 3. Check Operating Temperature sensor at CH heat exchanger outlet. If resistance is zero, replace the sensor. 4. Verify operation of internal boiler pump by checking rotation of pump shaft. (Manually spin pump shaft by inserting a flat head screwdriver. You may need to remove a side panel knock-out for better access). 5. If the problem persists, contact technical support. 	Hard Lock
20	Blocked condensate switch fault	<p>Press the Power button to clear the Error Code.</p> <ol style="list-style-type: none"> 1. Check Condensate and main controller connections. Ensure all are secure. 2. Check Condensate sensor resistance. If resistance is 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 Vent Pipe for blockages. 6. If the condensate is "hard piped" in the field, install a vent in the piping at a point higher than the condensate trap. 7. If the problem persists, contact technical support. 	Hard Lock
28	Overheat sensor fault	<p>This Error Code will go away when CH temperature decreases. If Error happens again:</p> <ol style="list-style-type: none"> 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, contact technical support. 	Soft Lock
29	Factory installed Jumper missing or not connected.	<ol style="list-style-type: none"> 1. Check upper left plug on PCB board. Reconnect blue jumper wire part of this plug. 2. Press the Power button to clear the Error code. Error occurs when the blue wire inside the KI-I9CCWL plug (upper left corner of PCB board) is shorted to ground or has a poor contact. 	Hard Lock
32	DHW outlet sensor fault	<p>This Error Code will go away when CH temperature decreases. If Error happens again:</p> <ol style="list-style-type: none"> 1. Check DHW or CH temperature sensor. Ensure connections are secure. 	Soft Lock
33	OP Water temperature sensor fault	<ol style="list-style-type: none"> 2. Check DHW or CH sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, contact technical support. 	

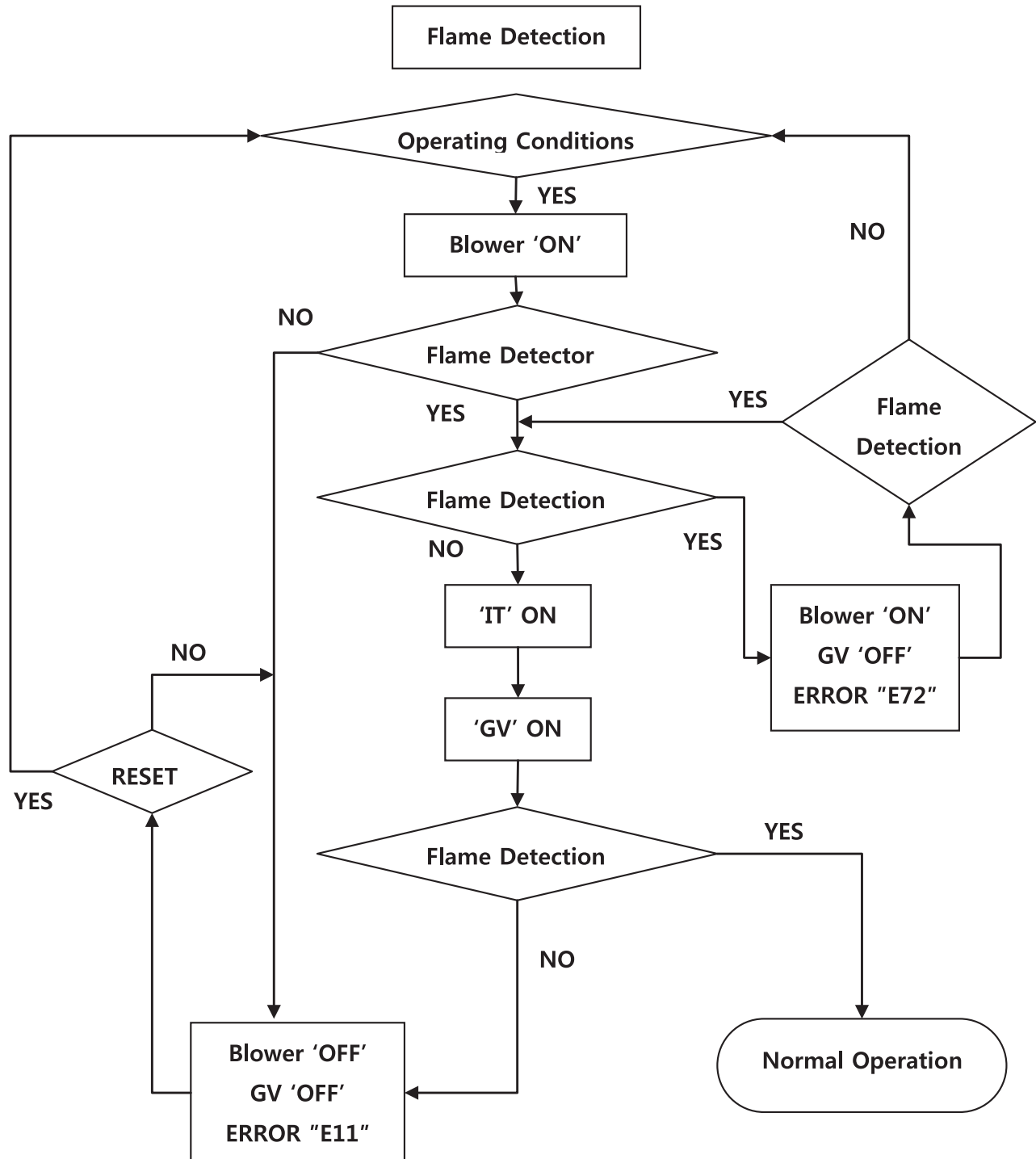
SECTION 6. Error Codes (continued)

Error Code	Error Code Description	Possible Remedies	Recover methods
32	DHW outlet sensor fault	This Error Code will go away when CH temperature decreases. If Error happens again: 1. Check DHW or CH temperature sensor. Ensure connections are secure. 2. Check DHW or CH sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, contact technical support.	Soft Lock
33	OP Water temperature sensor fault		
36	Main power fault	Supply voltage is too low to operate. This Error Code will go away when supply voltage 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, contact technical support.	Soft Lock
37	Power frequency fault	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, contact technical support.	Soft Lock
38	EPROM fault	Press the Power button to clear the Error Code. If the problem persists, contact technical support.	Hard Lock
40	Gas leakage fault	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 appliance 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, contact technical support.	Hard Lock
41	Fan high RPM fault	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 high, replace the fan. 4. Check intake and exhaust for blockages, debris, proper installation and placement. Check and record SFN (revision # of printed circuit board during start-up for future reference). 5. If the problem persists, contact technical support.	Hard Lock
42	External LWCO/safety fault	Press the Power button to clear the Error Code. If Error happens again: 1. Ensure the LWCO jumper wire is properly connected. 2. If the problem persists, contact technical support.	Soft Lock
43	Burner over-heating fault	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 zero, replace the switch. 3. If the problem persists, contact technical support.	Hard Lock
44	Air Pressure Sensor Range (APS) Fault	Press the power button to reset If error happens again: 1. Check the vent pipe for blockages. 2. Check the air intake pipe for blockages. 3. Inspect air intake filter screen located at the air intake adapter on top of the boiler. Clean if necessary. 4. Inspect the Venturi and fan motor, the air intake screen at the fan connection or the burner itself for any debris that could have been drawn in by the fan through the air intake. 5. If error does not clear, replace the APS. 6. If the problem persists, contact technical support.	Hard Lock
45	Air Pressure Sensor Fault	Check the aps connection. 1. If APS is closed and connections are secure, check APS connection. 2. If the problem is not happen, replace the APS 3. If the problem persists, contact technical support.	Soft Lock
61	Fan fault	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. Check intake and exhaust for blockages and debris. 3. 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. 4. If the problem persists, contact technical support.	Soft Lock

Error Code	Error Code Description	Possible Remedies	Recover methods
70	MCU self diagnostics fault	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 appliance. 2. If the problem persists, contact technical support.	Soft Lock
72	Flame Signal Fault	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check the appliance cover. Ensure it is secure. Flame detection sensor can detect an external light source. 2. Look thru boiler sight glass and check for glowing after burner shutdown. If you see glowing, do step 3. 3. Check burner plate by removing blower and boiler top plate and remove any debris from top of burner plate. Debris can come from PCV shavings during intake installation and/or from nearby dryer vents and landscapers causing debris being pulled in thru the air intake. Debris can glow after burner shutdown. 4. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 5. If the problem persists, contact technical support.	Soft Lock
76	Display to main control communication fault	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check connections from main control to display panel. 2. If the problem persists, replace the display and/or contact technical support.	Soft Lock
77	Outdoor sensor error	This Error Code will go away when the condition is remedied. If Error happens again: 2. Check outdoor sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, contact technical support.	Soft Lock
80	Internal low water cut-off fault	This Error Code will go away when the condition is remedied. If Error happens again: 1. Ensure all valves are open to the appliance 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, contact technical support.	Soft Lock
81	Internal low water cut-off fault	This Error Code will go away when the condition is remedied. If Error happens again: 1. Ensure all valves are open to the appliance 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, contact technical support.	Soft Lock
85	Anti-freeze fault (Appliance 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 appliance is located in a mechanical room protected from freezing conditions. 2. Ensure all valves are open to the appliance, there are no leaks. 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, contact technical support.	Soft Lock
94	Exhaust gas temperature fault	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check if dip switch Max 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, contact technical support.	Soft Lock

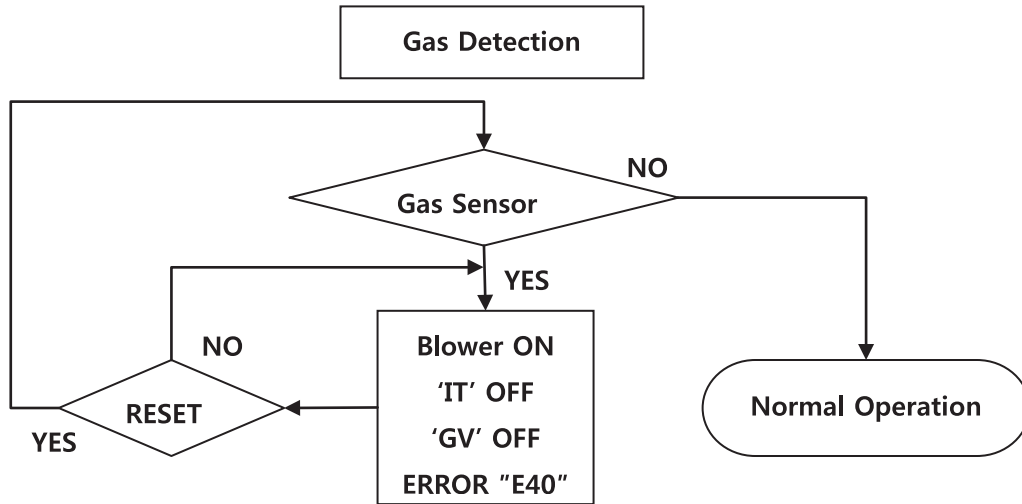
6.2 Fault Tree Analysis

1. Flame detection

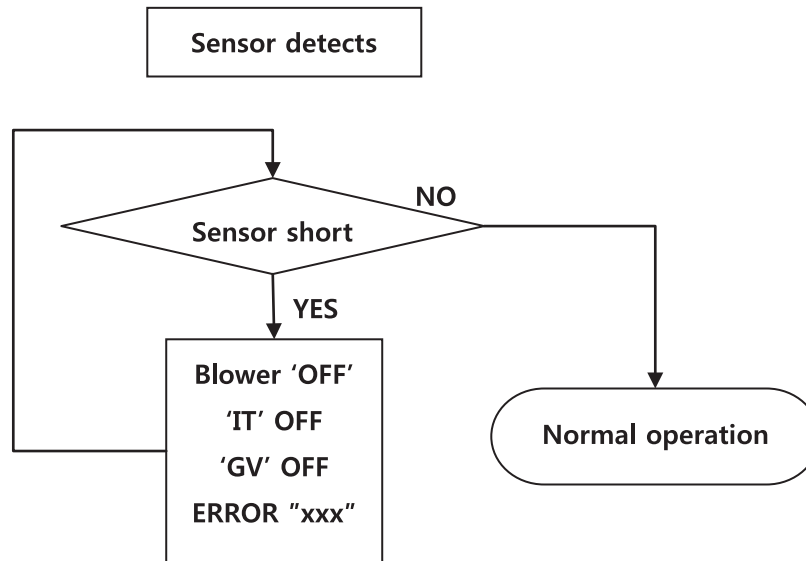


6.2 Fault Tree Analysis (cont)

2. Gas Detection



3. 'Storage', 'DHW', 'OP', 'CH overheat', 'Exhaust heat' Sensor detects



Error code	contents
E32	DHW NTC open or short
E33	OP NTC open or short
E35	Exhaust NTC open or short

SECTION 7 Trouble Shooting

7.1 Diagnostics

Question	Answer
The blower is still operating after the combustion stops.	This is normal because the blower keeps operating for 1 minute to vent (exhaust) the flue gas from the chamber once the combustion has stopped.
Temperature Rise too Quickly	Occurs when supply water temperature in heat exchanger rises faster than 2°F per second during the first two minutes the burner is on. Automatically resets after a few minute delay or using manual reset on control panel. See message displayed TEMPERATURE SENSOR and follow procedure for loose connections.
Abnormal sounds come from unit during operation.	A leak of combustion gas between sealed chamber and exhaust tube inside the unit. Call a qualified service technician for evaluation.
	Improper venting termination, make sure that the venting termination complies with specification.
	Check the supply gas pressure is sufficient. Insufficient gas pressure will cause unstable burner flame and noise.
CH Temp drops lower than expected before unit re-fires	Change Parameter 17:bo to 10 degrees F (5.5 degrees C)

7.2 Suggested Corrective Actions

This controller is able to record information about the boiler's condition at the time of the five previous faults or errors. Refer to the Section '5.11 Error Mode' of this manual.

Display	Condition	Diagnostic	Corrective Action(s)
Nothing shown on display control panel and blower running 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 12Vac.
Nothing is shown in display control panel and no other boiler components are operating.	Control is not receiving 120V power.	Check service switch and/or circuit breaker to boiler turned is on.	Turn on service switch to power boiler.
		Is there 120 Volts at the service switch?	Troubleshoot and correct the power supply to the manual switch.
		Is the ON/OFF POWER SWITCH (inside boiler case) turned on?	Turn ON the manual power switch inside the boiler case.
		Check for 120 volts at the line voltage terminal block located inside the boiler case.	Correct wiring inside the boiler case using the wiring diagram in this manual.
		Inspect the fuse. Replace if necessary.	Replace the fuse with proper part found in the replacement part section of this manual. If fuse blows again recheck wiring per diagram.
Nothing is shown on control panel, but boiler is operating.	Occurs when the communication 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.

7.2 Suggested Corrective Actions (continued)

Fault	Condition	Diagnostic	Corrective Action(s)
TEMPERATURE SENSOR	Occurs when a temperature sensor has electrically shorted (SHORT) or has become disconnected (OPEN).	Reset using manual reset screen on control panel. (Power button)	Check all the temperature readings of the boiler on the DIAGNOSTICS - TEMPERATURES menu to determine if any sensors are currently displayed as SHORT or OPEN.
			Check wire harness for loose connections and pin engagement at sensor Connection and Control module.
			If problem persists after checking items above replace Control. Refer to repair parts section for kit number.
FLAME FAULT	Occurs when flame is detected when there should be no flame.	Reset using manual reset screen on control panel. (Power button)	Burner may be operating too hot due to incorrect combustion. Inspect flame and conduct combustion test.
			Check for flame at burner via flame current with burner off. Turn boiler off and watch flame through observation port. If flame continues after shutdown replace gas valve.
BLOWER FAULT	Blower unable to reach required speed or does not reach 0 RPM when turned off.	Reset using manual reset screen on control panel. (Power button)	Check wire harness for loose connections and pin engagement at blower. Connections.
			Boiler in standby mode and blower not running. If BLOWER SPEED is not 0 RPM then replace blower.
			If blower does not rotate during ignition sequence check for 120V power at blower connection. If 120Vac power at blower motor and it doesn't start replace blower. Check power at Control. If 120Vac is not present at Control when boiler is powered replace Control.
IGNITION FAULT	Even if boiler went through 8 ignition attempts, but cannot detect flame	Power off and on.	Dirty burner and/or heat exchanger will cause high back pressure and poor ignition. Visual inspection of flue ways often will not be able to diagnose condition.
			Check incoming gas pressure with boiler off and at Max fire. Adjust within limits on rating label.
			Check for flue pipe and intake pipe restrictions or blockage
			Check burner fasteners and gaskets
GAS VALVE FAULT	The Control has detected a problem with it gas valve output circuit.	Reset using manual reset screen on control panel. (Power button)	Check wire harness connections between gas valve and Control.
			If lockout re-occurs replace Control.

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SECTION 8 Maintenance

8.1 Annual startup & general maintenance

■ Regular Maintenance

- This Manual should be placed in a safe and dry location near the boiler. Maintenance instructions should be carried out by the following guidelines.

■ Maintenance procedures [Daily]

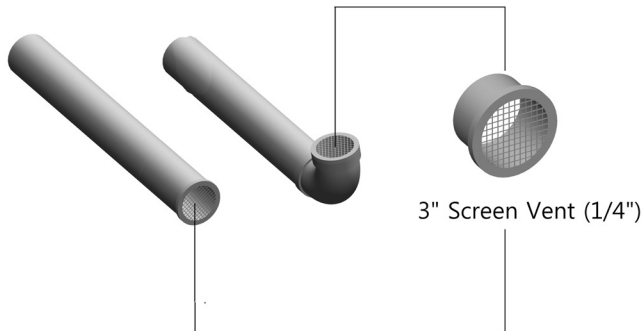
- **Check that the boiler front cover is closed.**
The front cover must be installed with both top latches tightened while the boiler is in operation.

⚠ WARNING

To prevent potential severe personal injury, death or substantial property damage, remove all contaminants or contaminated materials immediately from the area around the boiler. If exposed to contaminated materials, call a qualified service technician to inspect the boiler for possible damage from acid corrosion.

⚠ WARNING

DO NOT store combustible materials, gasoline or any other flammable vapors or liquids near the Boiler. Remove them immediately or store them other places.



- **Check the power source.**

Make sure that the power cord is correctly connected. The main power line is connected to the manual switch box inside the boiler. (Power line through the strain relief in the top of the boiler casing and fix it.)

- **Check the status of the control panel**

Check status of the power supply. Please check for any debris on the button.

■ Maintenance procedures [Monthly]

- **Check the vent pipe.**

Visually inspect the flue gas vent piping for detecting any signs of blockage, leakage or deterioration of the piping. Please contact a qualified service technician immediately if you find any problem.

- **Check the air inlet pipe.**

Visually inspect the air inlet piping and combustion. Inspect entire length of air piping for ensuring that piping is intact and all joints are properly sealed. To remove the combustion air filter (located on the left pipe), remove 2 holding screws and carefully slide out filter assembly. Clean thoroughly and put back in. Make sure no debris fell into the boiler. Call your qualified service technician if you notice any problems.

- **Check the relief valve.**

Inspect the boiler relief valve and the relief valve discharge pipe for any signs of weeping or leakage. If the relief valve often weeps, immediately contact your qualified service technician for inspecting the Combination boiler and system.

- **Check the condensate outlet.**

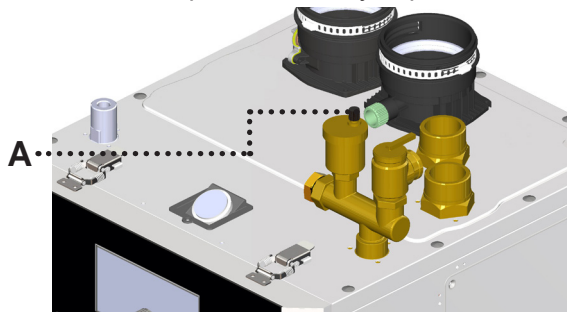
While the boiler is running, check the discharge end of the condensate drain tubing. Make sure that no flue gas is escaping from the condensate drain tubing. If flue gas is continuously escaping, it is a serious problem. Shut off the boiler and immediately. Call your qualified service technician for inspecting the boiler and condensate line. Also, refill the condensate trap if problem persists regularly.

- **Check the vent terminal screen vent (rodent screen).**

If you encounter a problem of combustion performance, visually inspect the terminal screen. And then replace it with spare parts or clean the screens.

- Check the air vent

If the air vent valve seems to work freely without leaking, close cap A fully. Loosen cap “A” one turn to allow vent to operate. If vent does not operate correctly, replace the vent.



If the valve continues to weep, contact your qualified service technician for inspecting the valve and system. If water does not flow from the valve even though you have lifted the lever completely, the valve or discharge line may be blocked. Shut down the boiler immediately. Call your qualified service technician to inspect the combination boiler and system.

- Check the burner state

You can clean the exterior of burner with a vacuum hose or dry cloth.. However, if you need to clean the inside of the burner stage, you should call a qualified service technician.

■ Maintenance procedures [Every 6 Months]

- Check the boiler piping (gas and water)

Visually inspect for leaks around internal water piping. Also inspect external water piping, circulators, relief valve and fittings. Immediately call a qualified service technician to repair any leaks. Leaks must be repaired by a qualified service technician immediately.

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

- Check the pressure relief valve

! WARNING

Leaks must be fixed by a qualified service technician immediately. Failure to comply with this instruction could result in severe personal injury, death or substantial property damage. This discharge line must be installed by a qualified heating installer or a service technician.

Before proceeding, verify that relief valve outlet has been piped to a safe place of discharge within 6 to 12” from a suitable floor drain, avoiding any possibility of scalding from hot water. 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 seat again to attempt to clean the valve seat.

8.2 Freeze Protection

FT Boilers are certified for indoor use only, and are not design-certified for placement outdoors.

Proper precautions for freeze protection are recommended for boiler installations in areas where the danger of freezing exists.

Power outage, interruption of gas supply, failure of system components, activation of safety devices, etc., may prevent a boiler from firing. **Any time a boiler is subjected to freezing conditions, and the boiler is not able to fire, and/or the water is not able to circulate, there is a risk of freezing in the boiler or in the pipes in the system.** When water freezes, it expands which may result in bursting of pipes, or damage to the boiler, which could result in leaking or flooding conditions.

NOTICE

Different glycol products may provide varying degrees of protection. Glycol products must be maintained properly in a heating system, or they may become ineffective. Consult the glycol specifications, or the glycol manufacturer, for information about specific products, maintenance of solutions, and set up according to your particular conditions.

NOTICE

Not all pumps are capable of maintaining the reduced temperature rise required with glycol concentrations greater than 35%.

WARNING

Do NOT use automotive antifreeze or ethylene glycol. Use only inhibited propylene glycol solutions which are specially formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets, seals, and metallic components used in hydronic systems. A correct glycol concentration and inhibitor level is critical.

Some items to consider are

- Consider the effects of reduced heat transfer and an increase in head pressure against the system circulator. For example: A 30% mixture of glycol will result in a BTU output loss of 15% with a 5% increase in head against the system circulator.
- Glycol mixtures should not exceed 40%. A 50% mixture of glycol will result in a BTU output loss of 30% with a 50% increase in head against the system circulator. Glycol concentrations above 40% by volume can lead to short cycling of the burner.
- The glycol solution should be tested as recommended by the glycol manufacturer but not less than annually. Some items of concern are pH additive breakdown, inhibitor reduction, etc.
- Glycol/antifreeze solutions expand more than water; therefore, system design must take this into account. For example: a 40% 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.

CAUTION

It is highly recommended to follow the manufacturers recommended concentrations, expansion requirements, and maintenance recommendations. You must carefully calculate the additional friction loss in the system as well as the reduction in the heat transfer coefficients.

NOTICE

Do not exceed a 40% glycol concentration by volume as it may result in short cycling of the burner.

SECTION 9 Installation Check

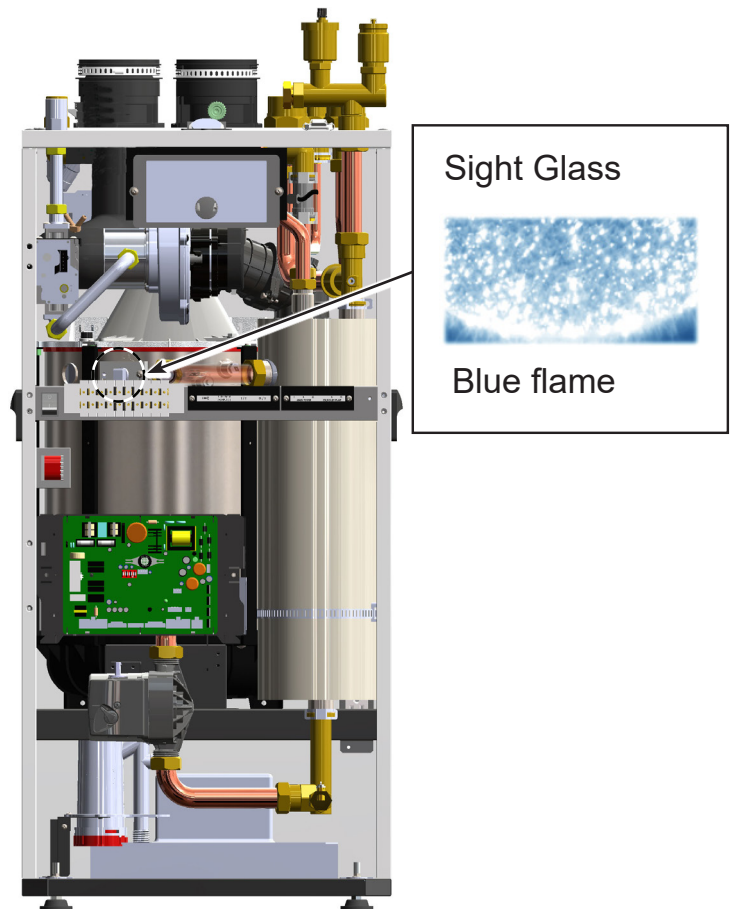
9.1 Quick View

- Before Installing
 - Make sure that there is enough space for installing DHW hot and cold, possible DHW recirc, space heating and gas piping.
Verify vent/air termination is located as required.
 - Propane boilers require a propane conversion kit, conversion parts and documentation are included.
- Install Water Piping
 - Boiler loop piping must be sized to the minimums listed in the Boiler manual. Using smaller piping will cause performance problems.(page 34)
- Install Vent & Air Piping
 - Slide the air inlet pipe and vent pipe into the Boiler vent connectors.
 - Make sure the terminations are placed as required in the manual and that air intakes are at least 12 inches above normal snow line.
 - Refer to the material check list in this guide for a list of items needed.
- Install Condensate Piping / Tubing & Components
 - Fill out the material check list in this guide to ensure you have the tubing or PVC pipe and all components needed for the condensate piping.
 - Connect internal components that are supplied with the Boiler.
 - For closet installations, a condensate pump can be placed inside the cabinet. A condensate discharge hose can exit the cabinet either near floor level via provided knock-outs, or via a knock-out in the upper right rear corner of the top panel. Route the 3/8" discharge hose carefully from the top into the boiler cabinet. The condensate pump can be plugged into the electrical outlet located on the inner back panel.
- Install Gas Piping
 - Install a union and shutoff valve.
- Wire the Boiler
 - Connect power wiring and control wiring per boiler manual wiring diagram.(Section 4.19)
- Start up, Adjust & Test
 - Follow the Boiler manual instructions to clean the system if needed, then fill and check water chemistry.

9.2 Final Check Lists

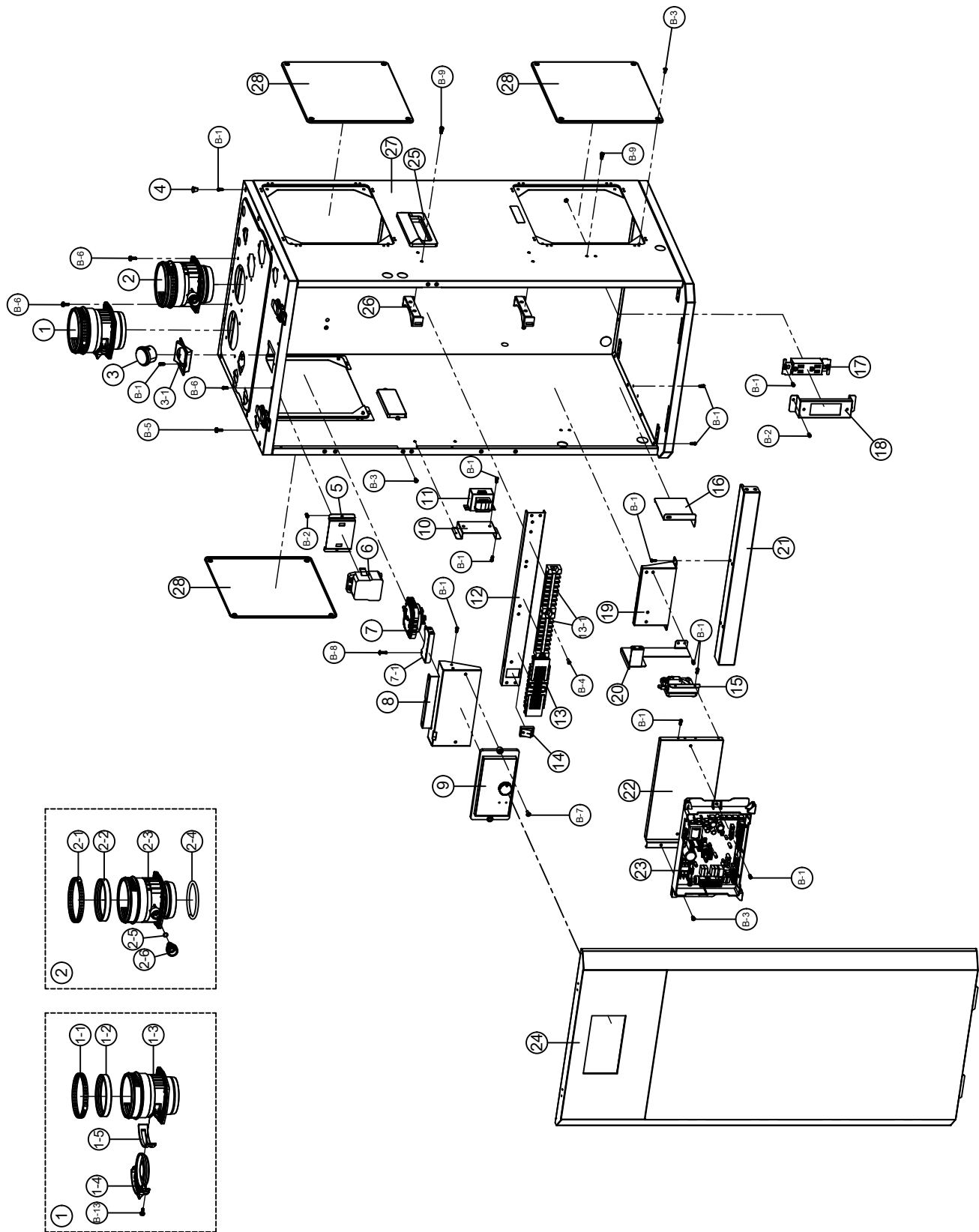
- Final check: Installation Conditions.
 - Is the Boiler placed level on a floor with sufficient strength?
 - Is there a floor drain near the Boiler?
 - Are there any combustible materials near the Boiler and vent pipe?
 - Is the air supply sufficient for proper operation of the Boiler?
 - Are the proper service clearances maintained?
 - Is the distance between the Boiler and point of vent termination minimized?
 - Is the proper distance from windows, doors, and other intake vents maintained?
- Final check: Gas pipe installation
 - Is the gas supply line equipped with a manual shut off valve near the boiler?
 - Is the gas supply line a minimum of 3/4" inner diameter?
 - Is the gas supply line length and diameter adequate to deliver the required BTU's?
 - Has the gas supply line pressure been measured?
 - Does the supply gas type match the type indicated on the boiler rating plate?
- Final check: Air/Vent pipe installation
 - Has the Boiler been vented with 3" or 2" PVC, CPVC, Polypropylene (PP), Stainless Steel or PP Flex Gas Vent (S636 PVC, CPVC) for Category IV appliances in accordance with this manual and/or your local code?
 - Is the vent termination at least 12" above the exterior grade?
 - Is the total vent length within the maximum vent length restriction?
 - Have you checked the air/vent piping for leaks?
 - Have you properly supported the vent termination?
 - Are all vent runs properly supported?
 - Is the vent sloped upward toward the vent termination at a rate of 1/4" per foot (2% grade)?
- Final check: Condensate drain installation
 - Have you installed a condensate drain line from the Boiler to a floor drain or under sink discharge point?
- Final check: Setting the DIP switches
 - Are all DIP switches correctly set on the main board?
 - Have you filled the condensate trap with water or vegetable oil to avoid drying out the trap?
 - When required, have you installed a neutralizer and condensate pump (in or near the boiler) and plugged the condensate pump into an electrical outlet?

- Final check : Connecting the power supply
 - Please check that the power is 120V AC.
 - Have you checked the polarity of the electrical connection?
- Final check : Pressure relief valve
 - Have you properly installed an approved pressure relief valve on the boiler?
- Final check : Burner flames
 - The burner flame must be checked periodically for a constant proper blue color.
 - If the flame does not appear normal, the burner may need to be cleaned.
 - If the burner needs to be cleaned, it must be performed by a qualified service technician.



SECTION 10 Parts List and Illustrations

FTHF199 Casing Assembly

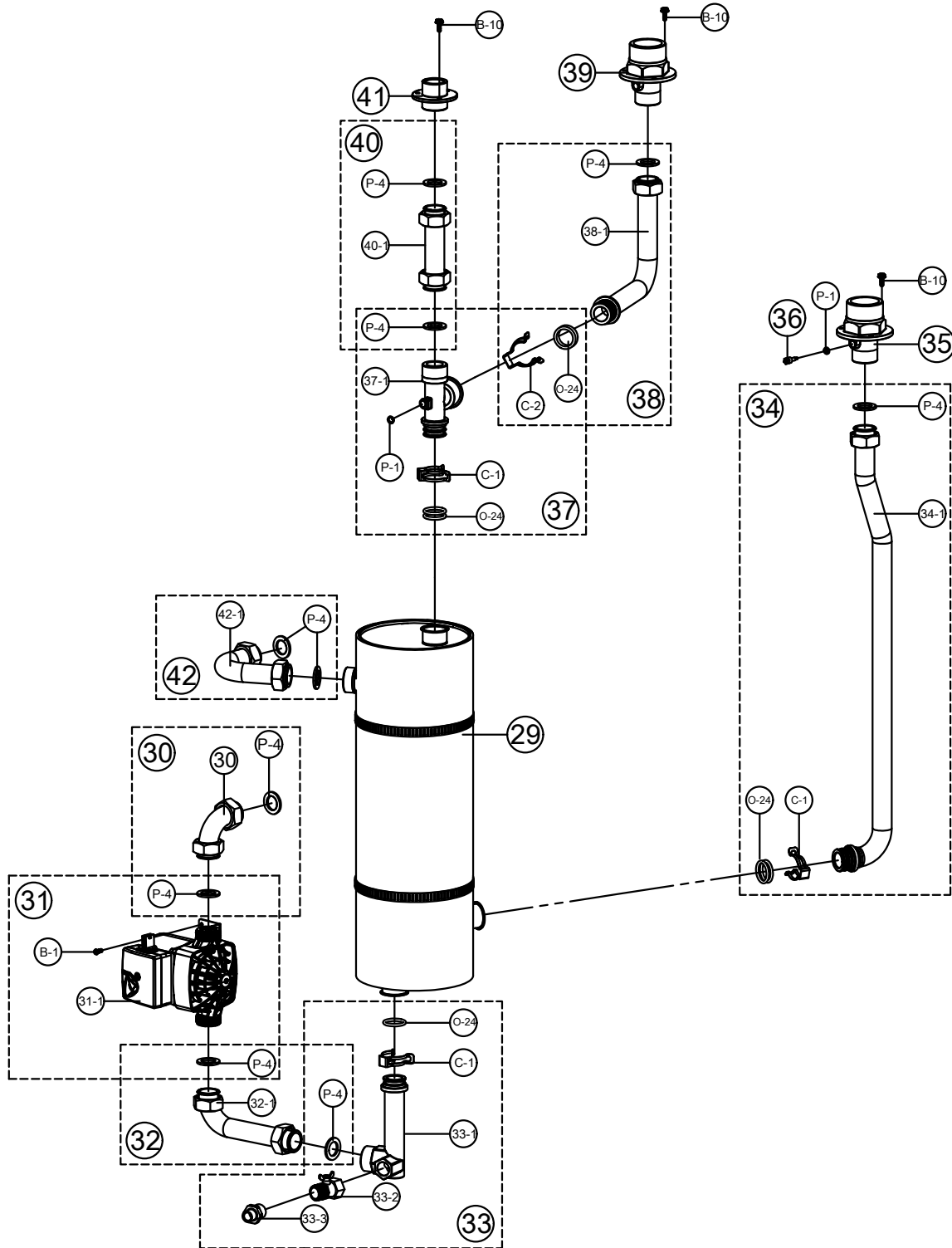


FTHF199 Casing Parts

No.	Description	Laars Part Number
1	Air Intake Collar Ass'y (filter type)	FT3010
1-1	Stainless Band(Ø100)	FT1603
1-2	Packing	FT1604
1-3	3 inch Air Intake Collar	FT3011
1-4	Air Filter	FT3012
1-5	Air Filter Packing	FT3013
B-13	M4 x 14MM Pan Head Screw (coarse thread)	
2	Vent Pipe Collar Ass'y	FT3015
2-1	Stainless Band(Ø100)	FT1603
2-2	Packing	FT1604
2-3	3 inch Vent Pipe Collar	FT3016
2-4	O-Ring P75	FT1609
2-5	O-Ring P7	FT1601
2-6	Exhaust Testing Cap	FT1606
3	CH Pressure Gauge	FT1058
3-1	Pressure Gauge Bracket	FT3017
4	Cover Bolt Cap	FT3018
5	Ignition Transformer Bracket	FT3019
6	Ignition Transformer	FT2031
7	Air Pressure Sensor(80)	FT1804
7-1	Air Pressure Sensor Bracket	FT3020
8	Control Sub Bracket	FT3021
9	Display Control	FT3129
10	Trans Bracket	FT3023
11	Trans (24V)	FT3024
12	Terminal Block Bracket	FT3025
13	Terminal Block(10P)	FT3026
13-1	Terminal Block(8P)	FT2007
14	Manual Power Switch	FT1020
15	Blocked Condensate Switch	FT1022
16	Condensate Trap Bracket 2	FT3027
17	Concentric Plug (110V)	FT3028
18	Concentric Plug Bracket (110V)	FT3029

No.	Description	Laars Part Number
19	Heat Exchanger Sub Bracket	FT3030
20	PCB Control Sub Bracket	FT3031
21	Bracket	FT3032
22	PCB Control Bracket	FT3033
23	Main PCB	FT3130
24	Front Cover	FT3035
25	Handle	FT3036
26	Tank bracket	FT3037
27	Casing Ass'y	FT3131
28	AS Cover	FT3039
B-1	M4 x 10MM Pan Head Screw (fine thread)	
B-2	M4 x 12MM Pan Head Screw (fine thread)	
B-3	M4 x 10MM Flat Head Screw (fine thread)	
B-4	M4 x 12MM Pan Head Screw (fine thread)	
B-5	M4 x 8MM Hex Head Screw (fine thread)	
B-6	M4 x 12MM Hex Head Screw (fine thread)	
B-7	M4 x 14MM Pan Head Screw (coarse thread)	
B-8	M4 x 16MM Pan Head Screw (fine thread)	
B-9	M5 x 12MM Washer Head Screw (fine thread)	

FTHF199 Tank and Water Pipe Assembly

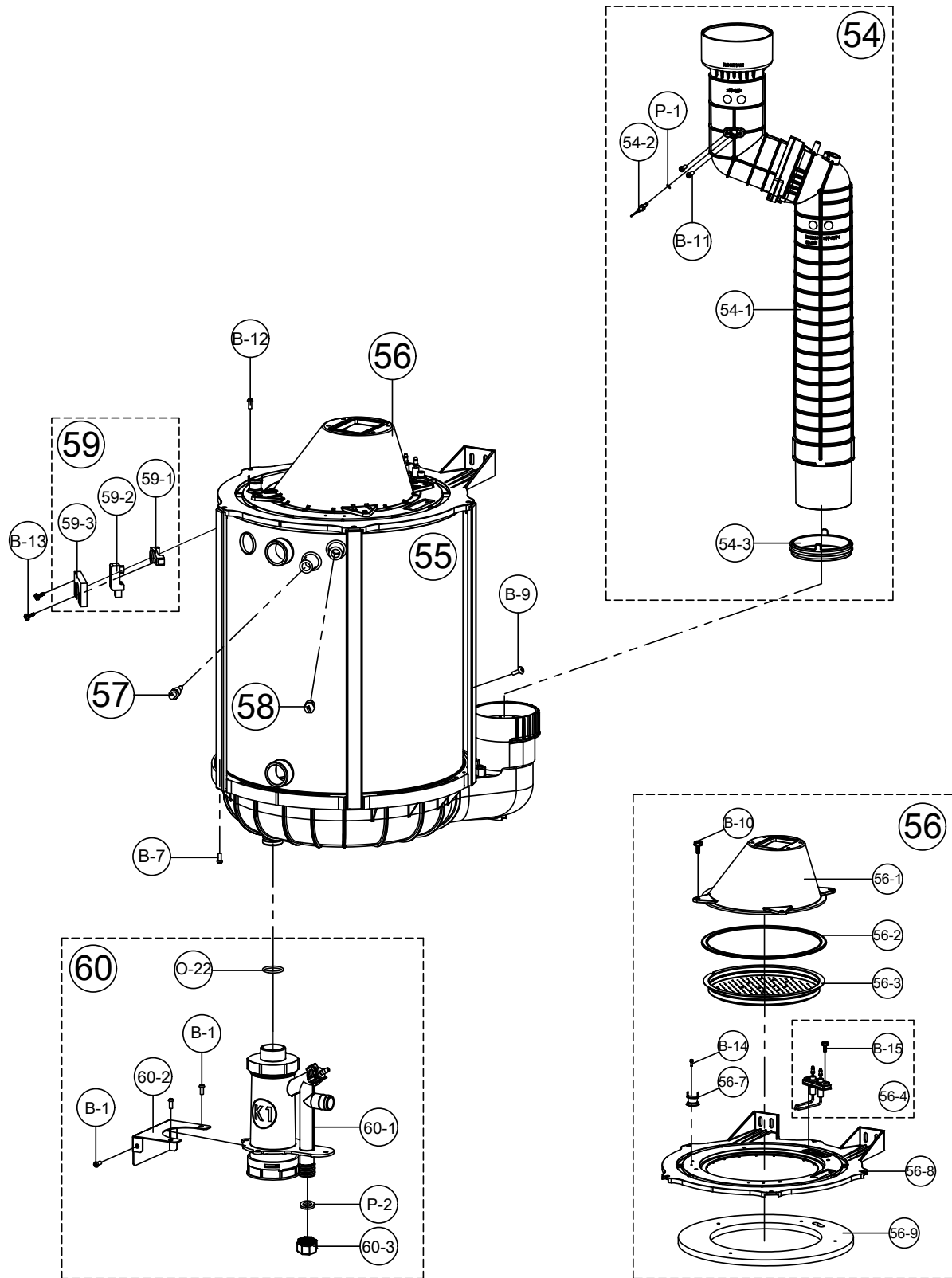


FTHF199 Tank and Water Pipe Parts

No.	Description	Laars Part Number
29	DHW Water Tank Ass'y	FT3132
30	Internal Circulation Pipe 2 Ass'y	FT3047
30-1	Internal Circulation Pipe 2	
P-4	1" Packing	FT1691
31	Boiler Pump Ass'Y	FT3049
31-1	Boiler Pump	
P-4	1" Packing	FT1691
B-1	M4 x 10MM Pan Head Screw (fine thread)	
32	Pump Bottom Pipe Ass'y	FT3051
32-1	Pump Bottom Pipe	
P-4	1" Packing	FT1691
33	CH Return Connection Ass'y	FT3053
33-1	CH Return Connection	
33-2	Ball Valve	FT1708
33-3	Short brass fitting	FT3055
C-1	Piping Clip1	FT1107
O-24	O-Ring P24	FT3056
P-4	1" Packing	FT1691
34	CH Return Pipe Ass'y	FT3057
34-1	CH Return Pipe	
C-1	Piping Clip1	FT1107
O-24	O-Ring P24	FT3056
P-4	1" Packing	FT1691
35	CH Return Connection	FT3059
36	CH Return Sensor	FT1635
37	3way Connection Ass'y	FT3060
37-1	3way Connection	
P-1	3/8" Packing	FT3062
P-4	1" Packing	FT1691
O-24	O-Ring P24	FT3056
C-1	Piping Clip1	FT1107
C-2	Piping Clip2	FT1108
38	CH Supply Pipe Ass'y	FT3063
38-1	CH Supply Pipe	
P-4	1" Packing	FT1691
O-24	O-Ring P24	FT3056
C-2	Piping Clip2	FT1108
39	CH Supply Connection	FT3065

No.	Description	Laars Part Number
40	Adapter Pipe Ass'y	FT3066
40-1	Adapter Pipe	
P-4	1" Packing	FT1691
41	Adapter Connection	FT3068
42	Internal Circulation Pipe 1 Ass'y	FT3069
42-1	Internal Circulation Pipe 1	
P-4	1" Packing	FT1691
B-10	M5 x 10MM Hex Head Screw (fine thread)	

FTHF199 Heat Exchanger and Tank Assembly

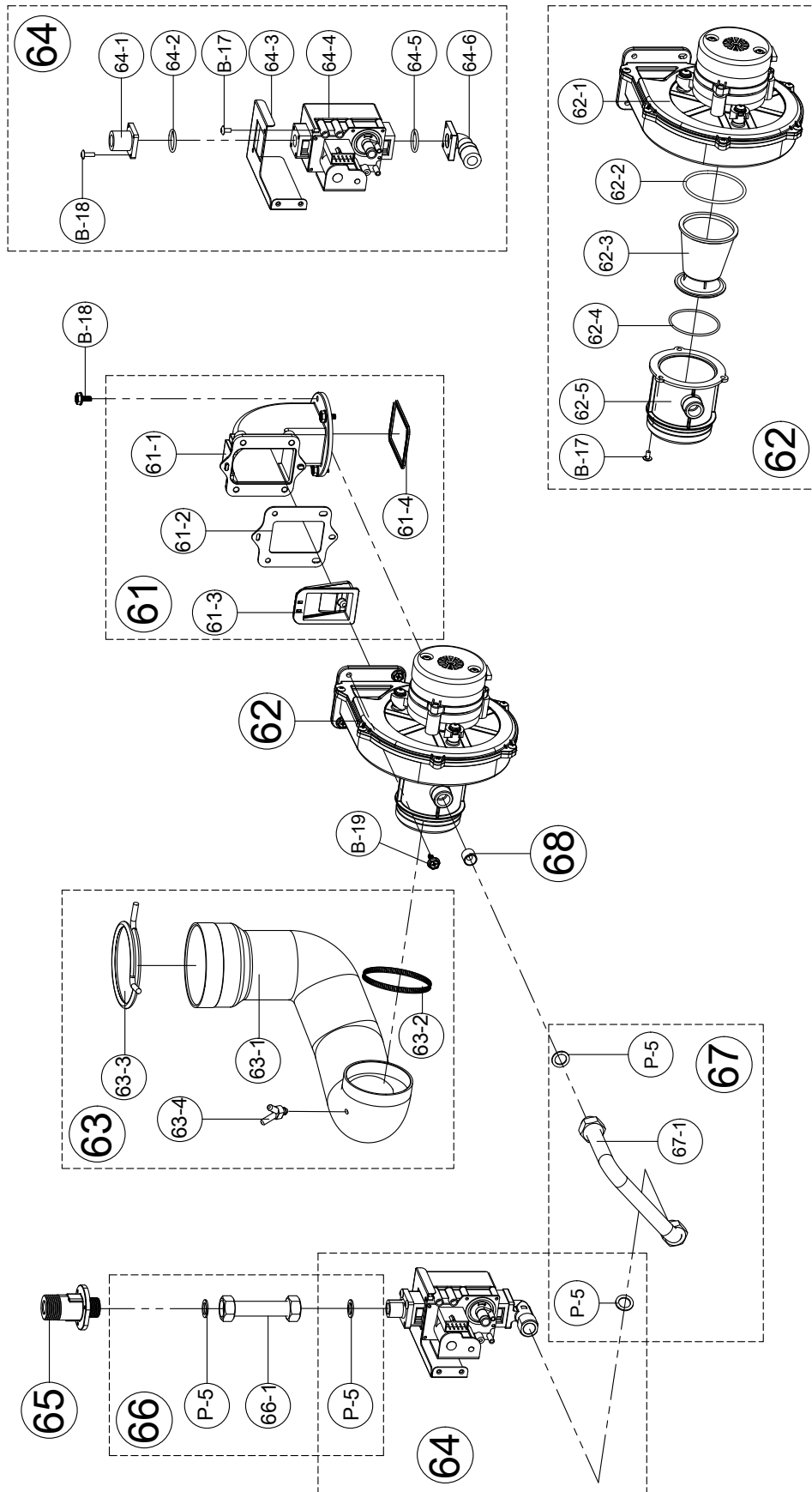


FTHF199 Heat Exchanger and Tank Parts

No.	Description	LAARS Part Number
54	Exhaust Duct Ass'y	FT3090
54-1	Exhaust Duct	
54-2	Exhaust Overheat Sensor	FT1307
54-3	Exhaust Duct Packing (Lower)	FT2036
P-1	3/8" Packing	FT3062
B-11	M4 x 9MM Hex Head Screw (coarse thread)	
55	Heat Exchanger Ass'y	FT3093
56	Burner Ass'y	FT3094
56-1	Burner Upper Case	FT1760
B-10	M5 x 10MM Hex Head Screw (fine thread)	
56-2	Burner Packing	FT1824
56-3	Burner	FT1838
56-4	Ignition Rod Ass'y	FT3127
B-15	M4 x 14MM Socket Head Cap Screw (fine thread)	
56-7	Overheat Sensor	FT1310
B-14	M3 x 6MM Socket Head Cap Screw (fine thread)	
56-8	Burner Downside Case	FT2041
56-9	Refractory	FT3095
57	Overheat Temperature Sensor	FT1324
58	Low Water Cut off Sensor	FT1325
59	Flame Detecting Sensor Ass'y	FT2085
59-1	Flame Detecting Sensor Bracket	FT1669
59-2	Flame Detecting Sensor	FT1327
59-3	Flame Detecting Sensor Cover	FT1069
B-13	M4 x 14MM Pan Head Screw (coarse thread)	
60	Condensate Trap Sub Ass'y	FT3098
60-1	Condensate Trap Ass'y	
60-2	Condensate Trap Bracket 1	FT3100
60-3	Condensate Trap Cap	FT3101
O-22	O-Ring P22	FT1644

No.	Description	LAARS Part Number
P-2	1/2" Packing	FT1875
B-7	M4 x 14MM Pan Head Screw (coarse thread)	
B-9	M5 x 12MM Washer Head Screw (fine thread)	
B-12	M5 x 16MM Pan Head Screw (fine thread)	

FTHF199 Fan and Gas Valve Assembly



FTHF199 Fan and Gas Valve Parts

No.	Description	Part Number
61	Fan Guide Ass'y	FT2087
61-1	Fan Guide	
61-2	Fan Rubber Packing #2	FT2020
61-3	Damper Body Ass'y	FT2044
61-4	Fan Guide Packing	FT1772
62	Fan Ass'y	FT3128
62-1	Fan	
62-2	Fan Sealing O-Ring	ST1038
62-3	AGM Venturi	FT1917
62-4	AGM O-Ring	FT1774
62-5	AGM Body	FT1775
B-17	M4 x 8MM Pan Head Screw (fine thread)	
63	Air Intake Hose Ass'y	FT3105
63-1	Air Intake Hose	
63-2	Stainless Band 1 (Ø90)	FT3107
63-3	Stainless Band 2 (Ø89)	FT1777
63-4	Nylon Barb Y Fitting	FT1918
64	Gas Valve Ass'y	FT3108
64-1	Gas Valve Inlet Adaptor	FT1538
64-2	Gas valve O-ring	FT1727
64-3	Gas valve bracket	FT3109
64-4	Gas Valve	FT1416
64-5	Gas Valve O-ring	FT1727
64-6	Gas Valve Outlet Adaptor	FT3008
B-17	M4 x 10MM Pan Head Screw (fine thread)	
B-18	M4 x 12MM Pan Head Screw (fine thread)	
65	Gas Inlet Adaptor	FT3110
66	Gas Inlet Pipe 1 Ass'y	FT3111
66-1	Gas Inlet Pipe 1	
P-5	1/2" Spiral Packing	FT1710
67	Gas Inlet Pipe 2 Ass'y	FT3113
67-1	Gas Inlet Pipe 2	
P-5	1/2" Spiral Packing	FT1710
68	Nozzle(natural)	FT1780
-	Nozzle(propane)	FT1802
B-18	M5 x 12MM Hex Head Screw (fine thread)	
B-19	M5 x 14MM Hex Head Screw (fine thread)	

FTHF199 Accessory Items

No.	Description	LAARS Part Number
1	Pressure Relief Valve	FT1500
2	Air Vent	FT3117
3	Brass Adaptor	FT3118
4	3/4" Brass Plug	FT3119
5	Outdoor Temp. Sensor	FT1501
6	Bird Screen 3"	FT1730
7	Spare Parts Kit	FT3133
8	Condensate Hose	FT3134
9	Silicone Hose	FT3126
10	Leveling Legs (Qty 4)	FT3122
11	Gas conversion kit	FT3123
12	Wire Harness (Optional)	FT3135

