Installation and Operation Instructions for

THE FT SERIES

Floor-Standing, Modulating Gas, Condensing, Combination Boiler

Model MFTCF

140,000 BTU/hr
199,000 BTU/hr

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

ENERGY STAR

Intertek

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 suivres 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 trovez.**
- **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 sservice 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.

H2373000D

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SECTION 1 Product Accessories

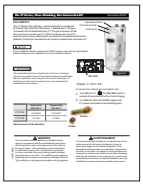
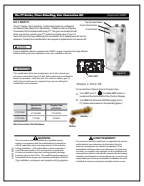
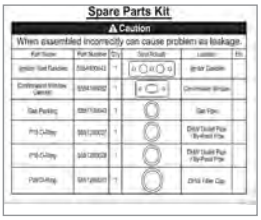
1.1 Introduction

This manual provides information necessary for the installation, operation, and maintenance of the **floorstanding FT**. 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.

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.

1.2 Included with the Unit

Item	Description	Qty
Floor-Standing, Combination Boiler FTCF140 or FTCF199		1
LP Conversion Kit. This kit includes the new LP orifice and the gas conversion instructions.	FTCF140   FTCF199  	1
Installation Instructions and User’s Manual	 	1 Each
Spare Parts Kit (Gaskets and O-Rings)	 	1
Condensate Hose		1

1.2 **Included with the Unit** (continued)

Items	Descriptions	Qty
Mesh screen (3" mesh)		2
Outdoor Sensor with Screws and Anchors		1
Pressure Relief Valve (CH LINE 3/4″ 30psi)		1

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.

1	2	3	4	5	6	7	8	9	10	11	12	13
M	F	T	C	F					A	1	X	N
SERIES				CONFIG	SIZE MBTU/h			FUEL	ALTITUDE	REVISION	OPTIONS	PUMP
FT			**C -** Combi	**F -** Floor Stnd	**1 4 0** **1 9 9**			**N -** Natural **P -** Propane	**A -** 0 -10,000 Feet	**1 -** First	**X -** Standard	**N -** with Pump

Model Nomenclature

Locating the model number

2.2 Specifications

Model Name			FTCF140			
Gas Input Rate	MAX		140,000 Btu/h			
	MIN		28,000 Btu/h			
Hot Water Capacity	35°F Rise		7.1 Gal			
	45°F Rise		5.5 Gal			
	77°F Rise		3.2 Gal			
Installation			Indoor / Floor stand type			
Flue System			Sealed Combustion Direct / Single / Concentric Vent/ SideWall Vent			
Vent Run			2"(50*ft) , 3"(100ft) Schedule 40 CPVC, PP			
Gas Supply Pressure	NG		3.5" WC to 10.5" WC			
	LP		8.0" WC to 13" WC			
Manifold Pressure			'NG' type combustibility		'LP' type combustibility	
			2" VENT	3" VENT	2" VENT	3" VENT
	FTCF140	MAX Fire	8.5~10.5%		9.5~11 %	
		MIN Fire	8~10%		9~10.5 %	
Power Supply	Main Supply		120V 60Hz / 6A			
	Maximum Power Consumption		160W			
Ignition System			Direct Electronic Ignition / Automatic Flame Sensing			
Burner System			Single Orifice Premixed Fuel Modulation Ceramic Infrared			
Gas Valve System			Combination modulating (Current proportional)			
Minimum Flow Rate			0.5 GPM			
Dimensions			W15.7" - H52.4" – D26.7"			
Shipping Weight			230 lbs (*104 kg*)			
Sub Heat Exchanger Water Capacity(DHW)			Under 15 Gallon			
Main Controller / Control Panel			GTX-920CP / P-920C			
Water Pressure			Min 15 ~ Max 150 PSI			
Connection Sizes	Cold Water Inlet / Hot Water Outlet		3/4" NPT			
	Space Heating Supply / Return		1" NPT			
	Gas Inlet		1/2" NPT			
Materials	Casing		Cold Rolled Carbon Steel			
	Heat Exchanger		Primary Heat Exchanger : Stainless Steel Sub Heat Exchanger : Stainless Steel			
Safety Devices			Flame Rod, Overheat Cut Off Device, Gas Valve Operation Detector, Exhaust Temperature High Limit Switch, Water Temperature High Limit Switch			

***Allowable 2" vent length for propane is 25'**

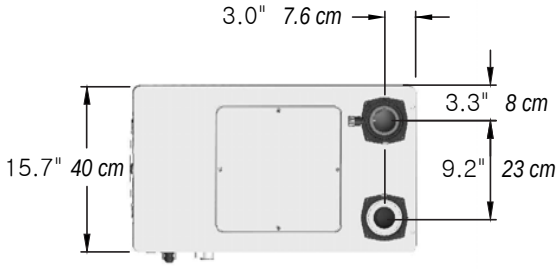
Model Name			FTCF199			
Gas Input Rate	MAX		199,000 Btu/h			
	MIN		19,900 Btu/h			
Hot Water Capacity	35°F Rise		9.88 Gal			
	45°F Rise		7.7 Gal			
	77°F Rise		4.8 Gal			
Installation			Indoor / Floor stand type			
Flue System			Sealed Combustion Direct / Single / Concentric Vent/ SideWall Vent			
Vent Run			2"(50ft*) , 3"(100ft) Schedule 40 CPVC, PP			
Gas Supply Pressure	NG		3.5" WC to 10.5" WC			
	LP		8.0" WC to 13" WC			
Manifold Pressure			'NG' type combustibility		'LP' type combustibility	
			2" VENT	3" VENT	2" VENT	3" VENT
	FTCF199	MAX Fire	8.5~10.0%		9.5~11 %	
		MIN Fire	8~10%		9~10.5 %	
Power Supply	Main Supply		120V 60Hz / 6A			
	Maximum Power Consumption		160W			
Ignition System			Direct Electronic Ignition / Automatic Flame Sensing			
Burner System			Single Orifice Premixed Fuel Modulation Ceramic Infrared			
Gas Valve System			Combination modulating (Current proportional)			
Minimum Flow Rate			0.5 GPM			
Dimensions			W15.7" - H53.7" – D26.7"			
Shipping Weight			242 lbs (*110 kg*)			
Sub Heat Exchanger Water Capacity(DHW)			Under 15 Gallon			
Main Controller / Control Panel			GTX-920CP / P-920C			
Water Pressure			Min 15 ~ Max 150 PSI			
Connection Sizes	Cold Water Inlet / Hot Water Outlet		3/4" NPT			
	Space Heating Supply / Return		1" 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			Flame Rod, Overheat Cut Off Device, Gas Valve Operation Detector, Exhaust Temperature High Limit Switch, Water Temperature High Limit Switch			

Note; The greatest installation difference between the FTCF140 and FTCF199, other than general output capability (BTU's), is that the air inlet and exhaust vents are opposite. See Section 2.4

***Allowable 2" vent length for propane is 25'**

2.3 Dimensions

FTCF140



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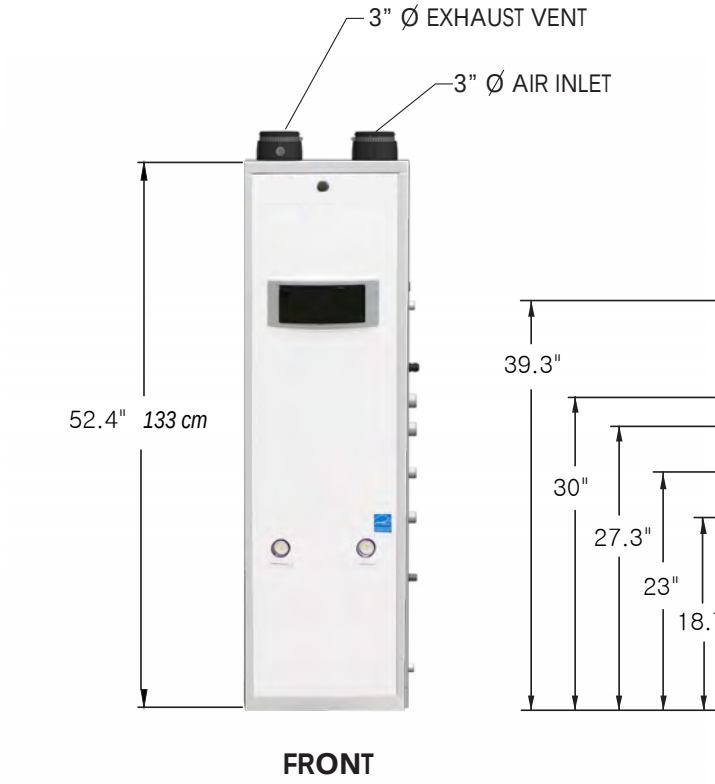
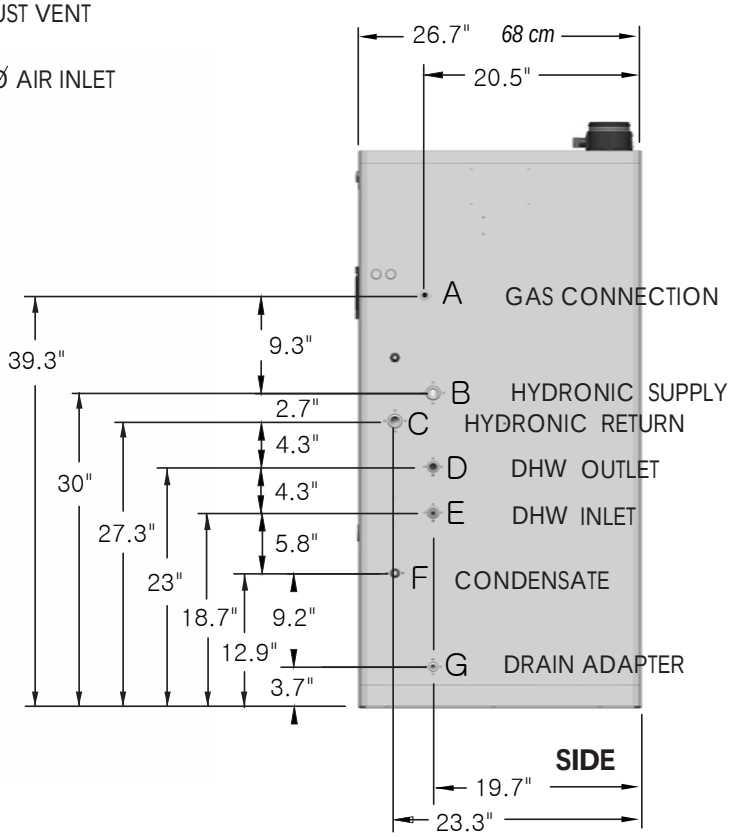


FRONT

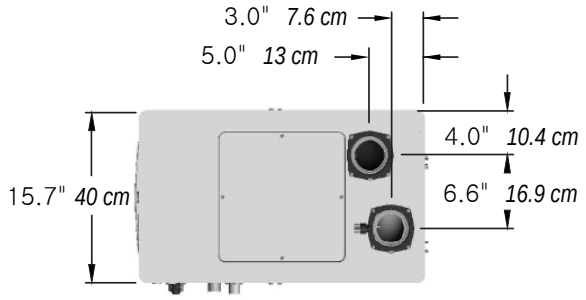


SIDE

	Description	Diameter
A	Gas Connection	3/4" NPT
B	'CH supply' Connection	1" NPT
C	'CH return' Connection	1" NPT
D	'DHW outlet' Connection	3/4" NPT
E	'DHW inlet' Connection	3/4" NPT
F	Condensate	1/2" NPT
G	Drain	1/2" NPT

FTCF199

Note: The greatest installation difference between the FTCF140 and FTCF199, other than general output capability (BTU's), is that the air inlet and exhaust vent are opposite.



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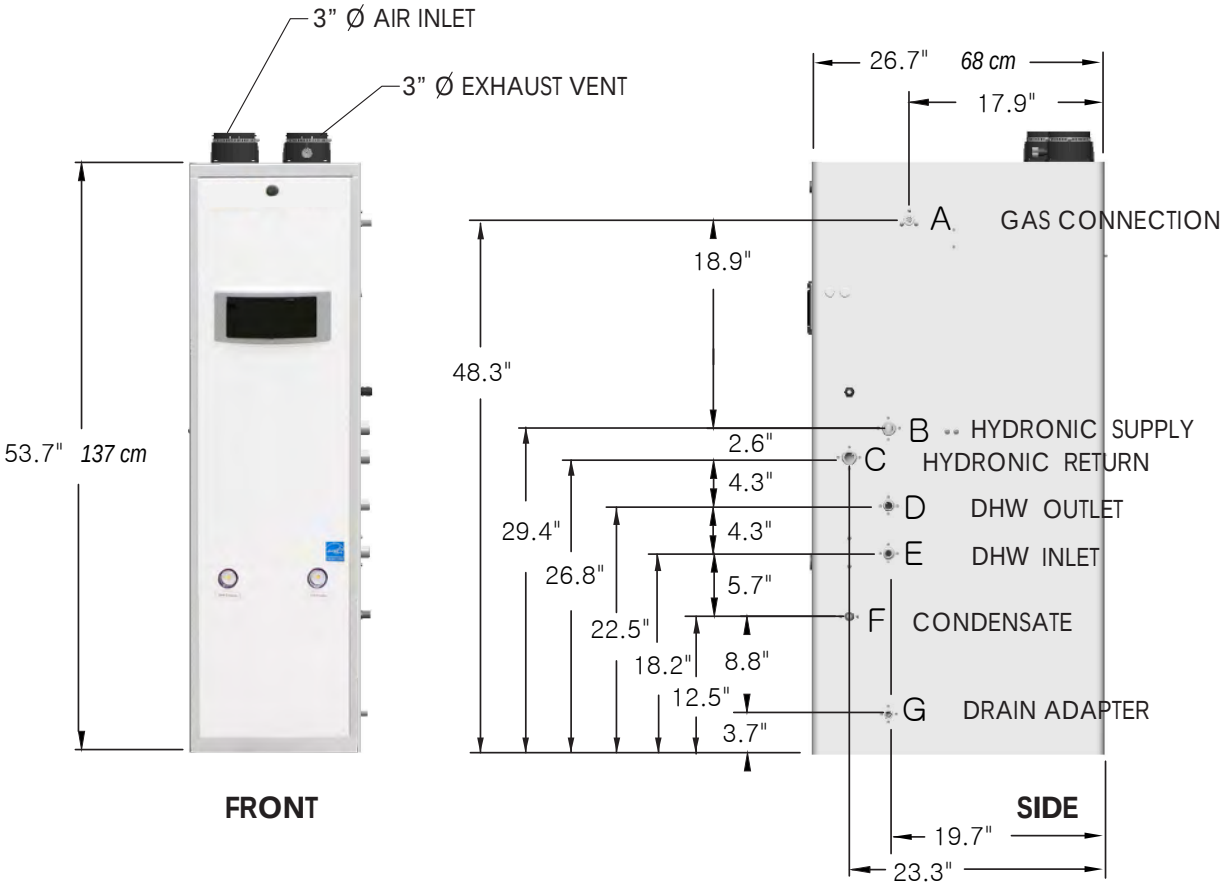


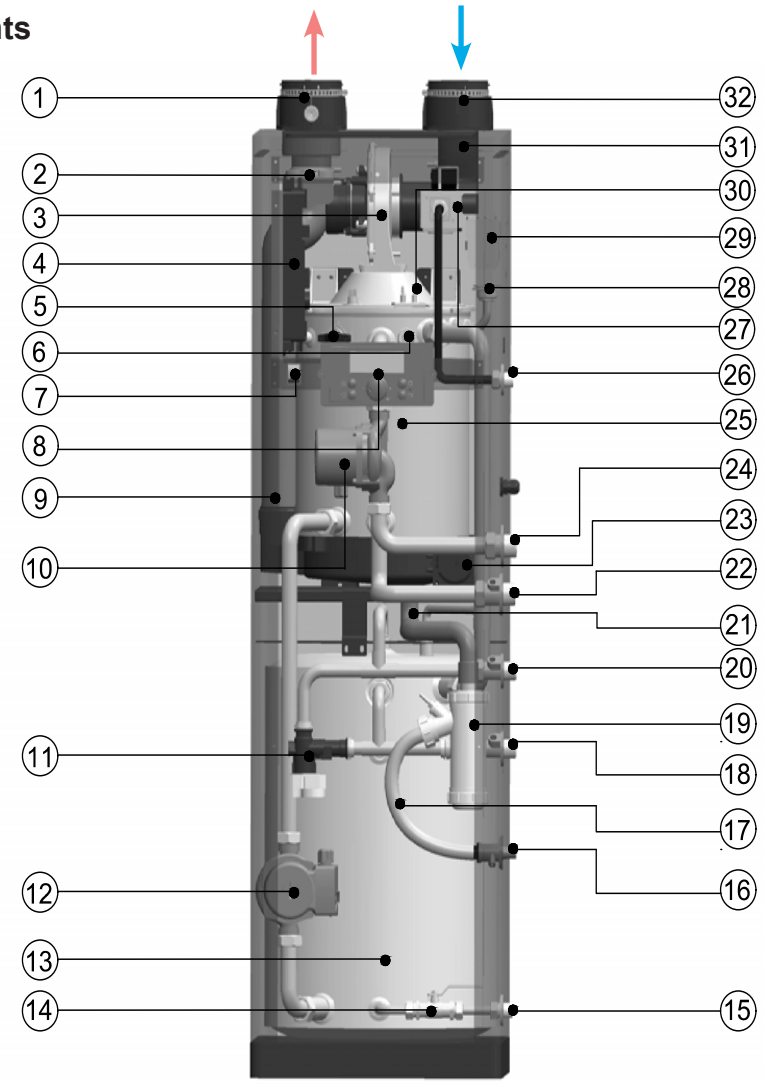
FRONT

SIDE

	Description	Diameter
A	Gas Connection	3/4" NPT
B	'CH supply' Connection	1" NPT
C	'CH return' Connection	1" NPT
D	'DHW outlet' Connection	3/4" NPT
E	'DHW inlet' Connection	3/4" NPT
F	Condensate	1/2" NPT
G	Drain	1/2" NPT

2.4 Names of Components

FTCF140

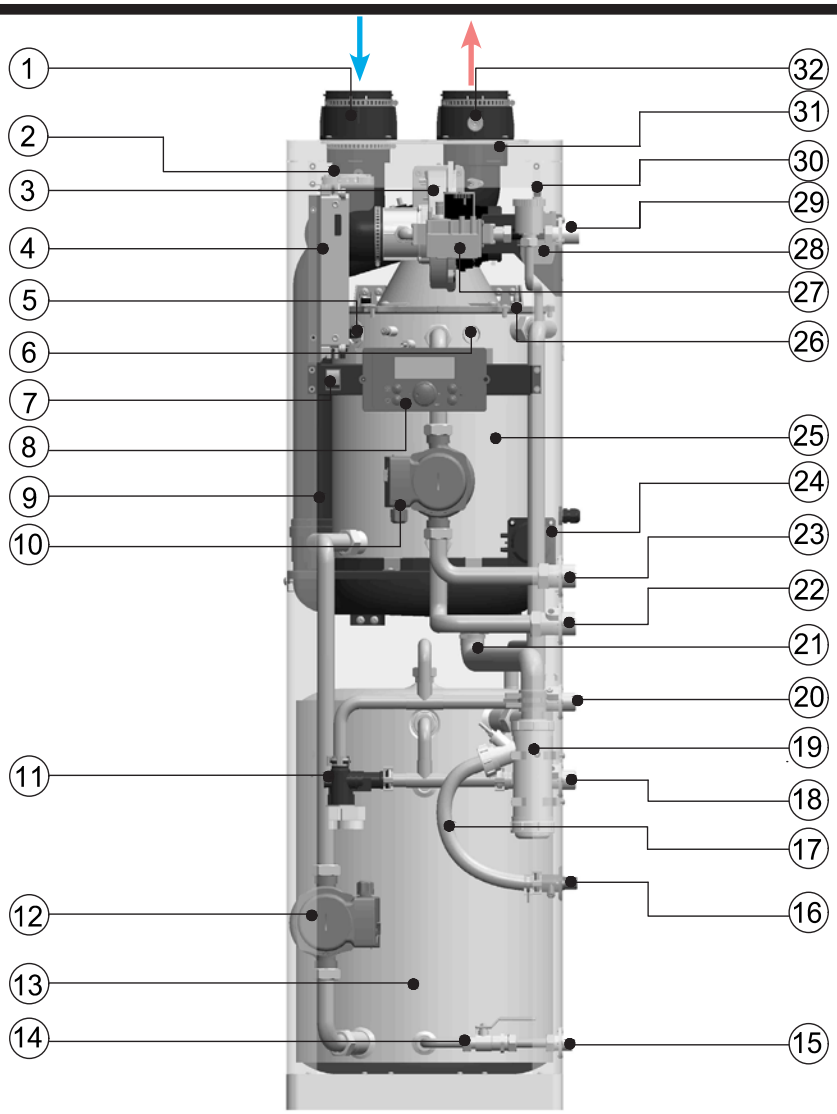


NO	Name of Component
1	Exhaust Vent
2	Air Pressure Sensor
3	Blower
4	PCB Bracket
5	Flame Detection Sensor
6	Sight Glass
7	Manual Switch
8	Display Control
9	Exhaust Pipe
10	Recirculation Pump (CH)
11	Mixing Valve
12	Recirculation Pump (DHW)
13	DHW Tank Assembly
14	Water Drain Valve
15	Water Drain Adapter
16	Condensate Trap Adapter

NO	Name of Component
17	Condensate Drain Hose
18	DHW Inlet Adapter
19	Condensate Trap
20	DHW Outlet Adapter
21	Condensate Heat Exchanger Hose
22	CH Return Connection
23	Air Pressure Switch
24	CH Supply Connection
25	Heat Exchanger
26	Gas Inlet Connection
27	Gas Valve
28	Air Vent (air eliminator)
29	Ignition Transformer
30	Igniter
31	Air Intake Pipe
32	Air Inlet

FTCF199

Note: The greatest installation difference between the FTCF140 and FTCF199, other than general output capability (BTU's), is that the air inlet and exhaust vent are opposite.



NO	Name of Component
1	Air Inlet
2	Air Pressure Sensor
3	Blower
4	PCB Bracket
5	Sight Glass
6	Flame Detection Window
7	Manual Switch
8	Display Control
9	Air Intake Pipe
10	Recirculation Pump (CH)
11	Mixing Valve
12	Recirculation Pump (DHW)
13	DHW Tank Assembly
14	Water Discharge Valve
15	Water Discharge Adapter
16	Condensate Trap Adapter

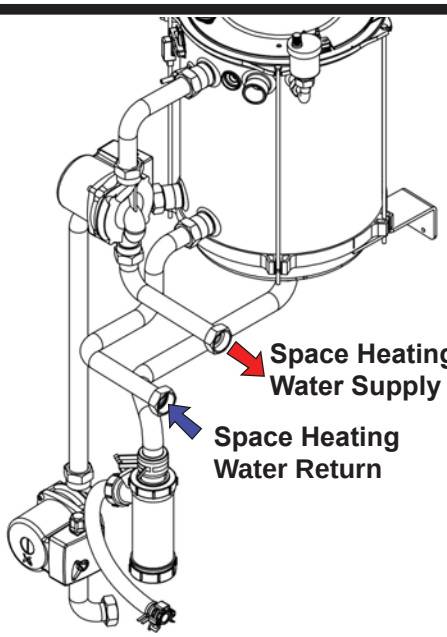
NO	Name of Component
17	Condensate Drain Hose
18	DHW Inlet Adapter
19	Condensate Trap
20	DHW Outlet Adapter
21	Condensate Heat Exchanger Hose
22	CH Return Connection
23	CH Supply Connection
24	Air Pressure Switch
25	Heat Exchanger
26	Igniter
27	Gas Valve
28	Ignition Transformer
29	Gas Inlet Connection
30	Air Vent (air eliminator)
31	Exhaust Pipe
32	Exhaust Vent

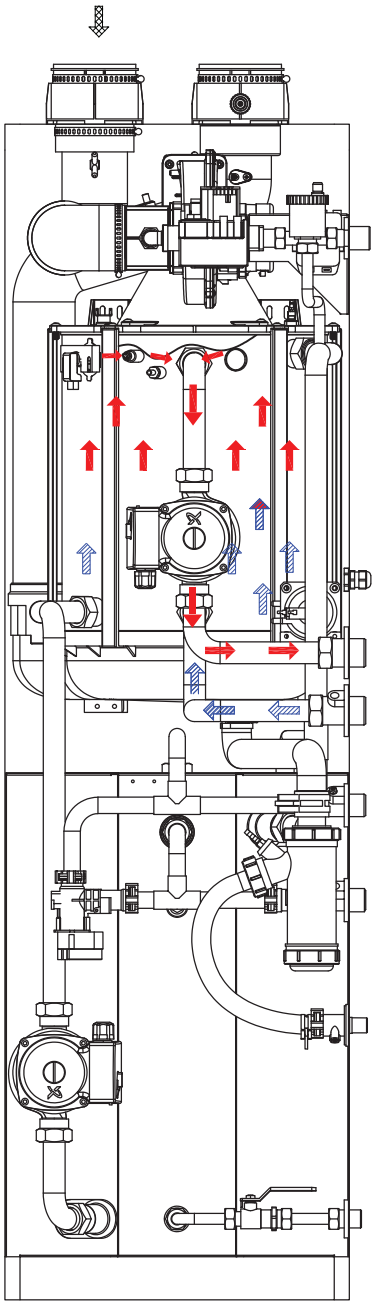
2.5 Product Flow Paths and Characteristics

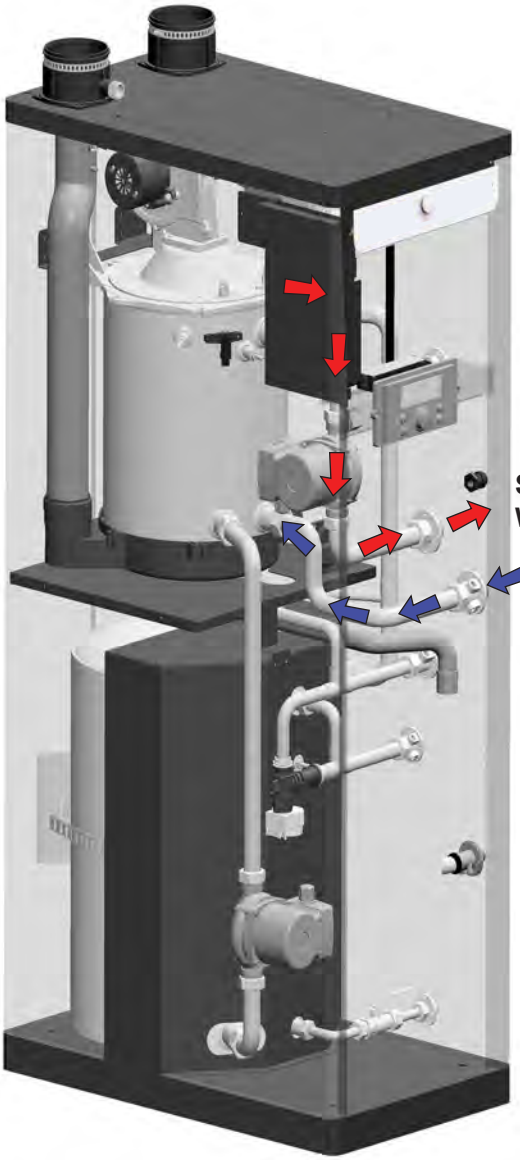
2.5.1 **Central Heating flow.**

Combination Boiler Heating Mode.

Water in the heating pipe is used for space heating.





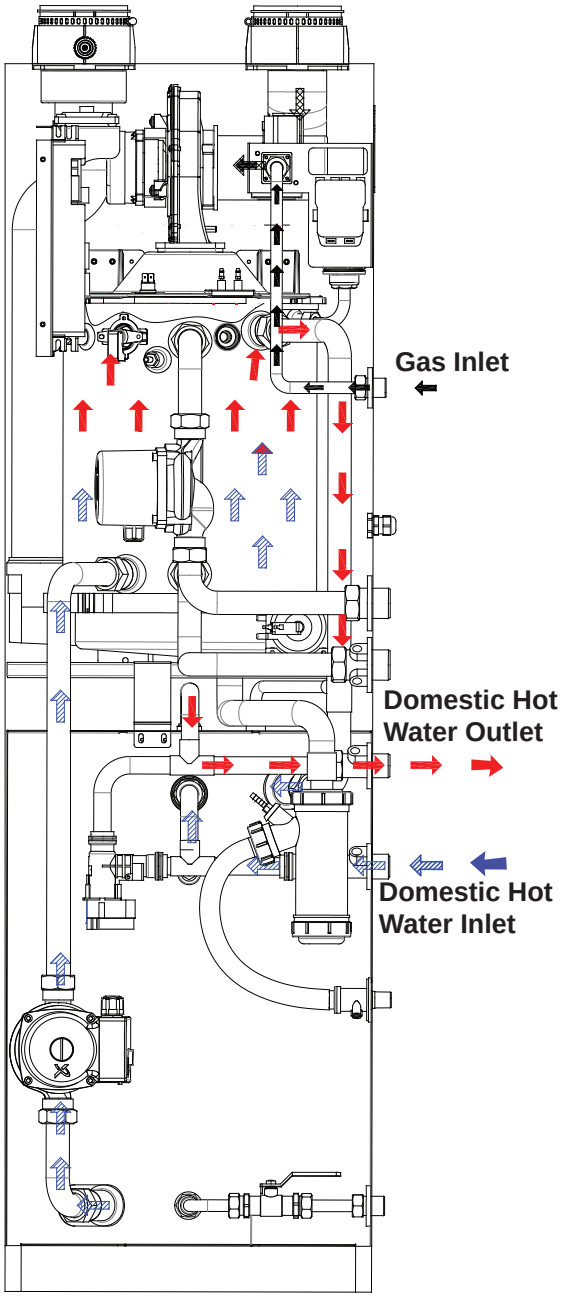


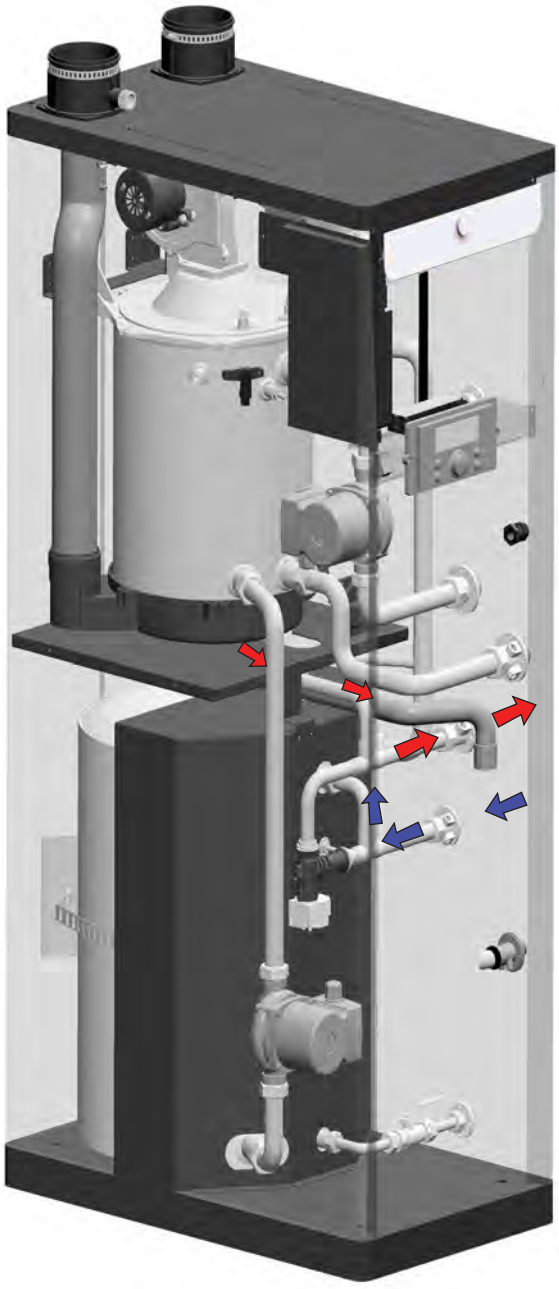
Note: The condensate trap has been hidden to simplify the view

2.5.2 **Domestic Hot Water flow.**

Combination Boiler Domestic Hot Water Mode.

Cold water passes through the exchanger and is heated via a mini indirect tank.
The domestic hot water (DHW) is provided on demand.





Note: The condensate trap has been hidden to simplify the view

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

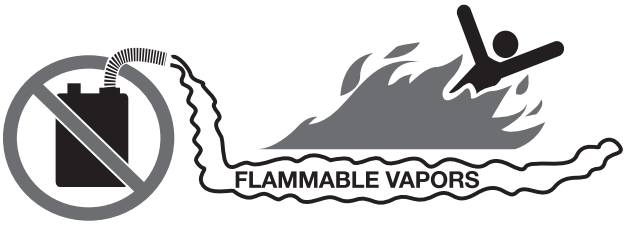
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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 4,500ft(1,370m) in accordance to the latest CSA/CGA 2.17-M91 Gas-Fired Appliances for Use at High Altitudes.



⚠ DANGER

- Vapors from flammable liquids can explode and catch on fire, resulting in severe burns or death. 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 combination 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 '41' 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.

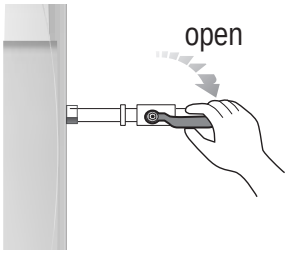
3.2 Safety Precautions and Proper Use

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 Gas Valve
Check that the manual gas shut-off valve that supplies the FT is opened.

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 ⚠ CAUTION

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 intermediate gas valve.
3. Open windows for ventilation.
4. Call a qualified service technician for immediate repair.

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.

⚠ 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.

⚠ **CAUTION**

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

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

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. The ceramic heater is installed inside of the heater's internal pipe to protect the heater from freezing.

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.

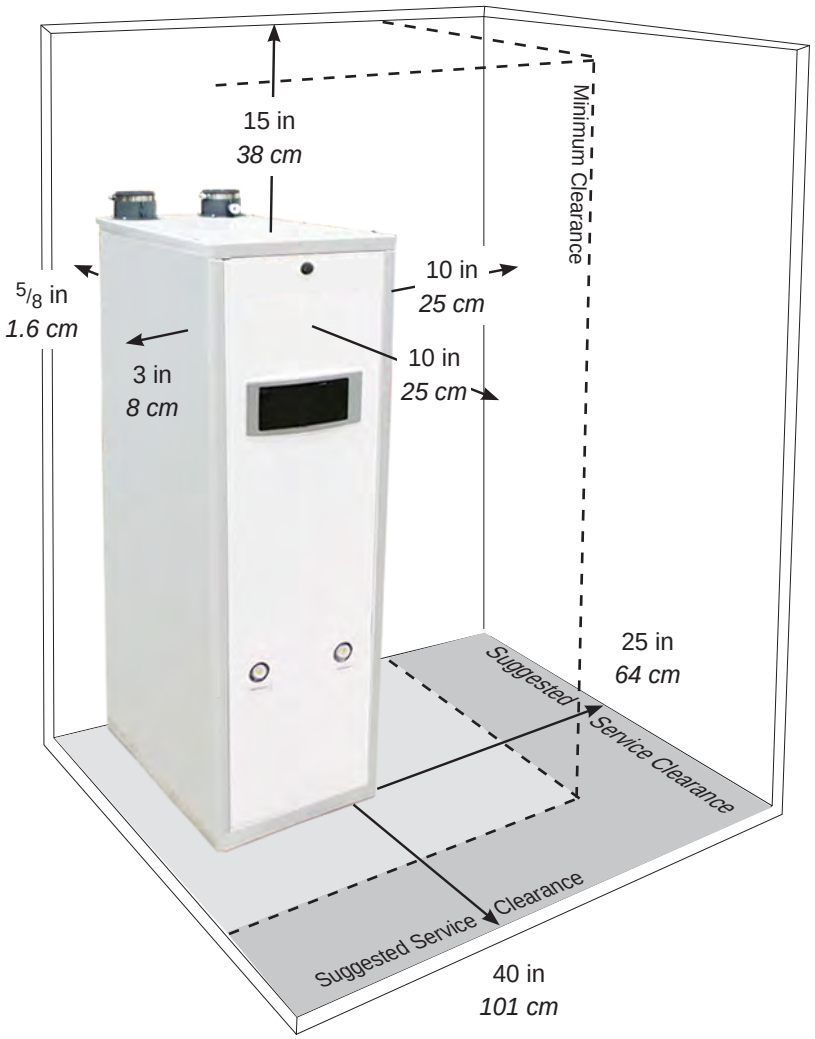
Do not disassemble the Boiler.

If repair is required, call your local qualified technician.

SECTION 4 Installation

4.1 Location and Clearances

The appliance should be located to provide clearances on all sides for maintenance and inspection. It should not be located in an area where leakage of any connections will result in damage to the area adjacent to the appliance or to lower floors of the structure. When such a location is not available, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance.
FT Boilers must never be installed on carpeting. The location for the appliance should be chosen with regard to the vent pipe lengths and external plumbing and on a level surface. The unit shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, control replacement, etc.). When vented vertically, the FT must be located as close as practical to the vertical section of the vent. If the vent terminal and/or combustion air terminal terminate through a wall, and there is potential for snow accumulation in the local area, both terminals should be installed at an appropriate level above grade or the maximum expected snow line.



Minimum clearances to Combustibles.

Minimum Clearances		
For installation From Non-Combustibles /combustibles		Suggested Service Clearance
Top of appliance	15 in *(38 cm)*	15 in *(38 cm)*
Back of appliance	5/8 in *(1.6 cm)*	5/8 in *(1.6 cm)*
Front of appliance	10 in *(25 cm)*	40 in *(101 cm) or more*
Side of appliance(right)	10 in *(25 cm)*	25 in *(64 cm) or more*
Side of appliance(left)	3 in *(8 cm)*	3 in *(8 cm)*
Bottom of appliance	0in *(0 cm)*	0in *(0 cm)*

Table 1. Minimum Clearances to Combustibles and Suggested Service Clearance.

⚠ 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 Combination boiler
- Always check the connected components which are near to the heater. The components are below.

■ Water piping position / Venting adapter / Gas supply piping / Electrical power / Condensate drain hose.
- Inspect area around Combination boiler. Remove any combustible materials, gasoline and other flammable liquids. Failure to keep Combination 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 Combination boiler which has gas control system components must be protected from any possible danger during operation and service.
- If new Combination 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 heater 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.

■ The boiler must be installed on a wall that can bear its weight.

⚠ 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.

SECTION 4. Installation (continued)

4.2 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.

An 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.

4.2.1 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

4.2.2 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. The unit must not support the weight of the combustion air intake pipe. Maximum linear pipe length allowed is shown in Table 5. Subtract 5 allowable linear ft. (1.5m) for every elbow used.

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 a slope 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.

⚠ CAUTION

- The FT is standard as a Natural Gas Boiler and must be converted if propane is the desired gas, unless specifically manufactured for propane.

- 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.

⚠ 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.

SECTION 4. Installation (continued)

4.3 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 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) in non-metallic venting systems is prohibited and covering non-metallic vent pipe and fittings with thermal insulation is prohibited.

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	ANSI/ASTM F441	
Polypropylene	UL1738 or ULC-S636	

Table 3. Required Exhaust Vent Material.

4 . **Vent system components must not be mixed with alternate manufacturers certified components and/or unlisted components.**

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 heater 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.).

4.4 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.

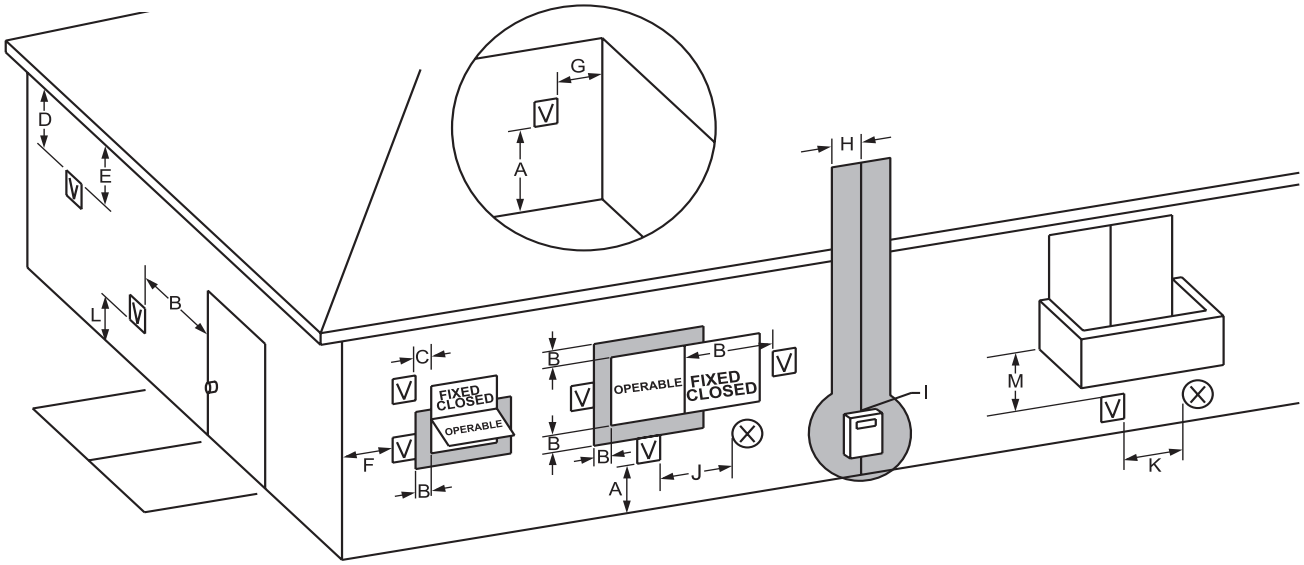
2. The Boiler is designed to be installed as a Direct Vent (sealed combustion) type. The air for combustion must be supplied directly from the outside to the burner. Also, the flue gases must be vented directly to the outdoors (through wall or roof).

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 contaminates, 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 endpiece is one (1) foot.

4.5 Locations for Vent Pipe Terminator

4.5.1 Direct Venting Clearances



		U.S. Installations (see note 1)	Canadian Installations (see note 2)
A=	Clearance above grade, veranda, porch, deck, or balcony	12 inches (30 cm) See note 6	12 inches (30 cm) See note 6
B=	Clearance to window or door that may be opened	Direct vent only: 12 inches (30cm); Other than Direct vent: 4 ft (1.2m) below or to side of opening; 1 ft (30cm) above opening	36 inches (91 cm) NT 80 only - 12 inches (30 cm)
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 feet (61cm) 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 center line extended above meter/regulator assembly	See note 4	3 feet (91 cm) within a height 15 feet above the meter/regulator assembly
I=	Clearance to service regulator vent outlet	See note 4	3 feet (91 cm)
J=	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	Direct vent only: 12” (30cm) 80-285; 36” (91cm) 399-850. Other than Direct vent: 4 ft (1.2m) below or to side of opening; 1 ft (30cm) above opening	36 inches (91 cm) NT 80 only - 12 inches (30 cm)
K=	Clearance to a mechanical air supply inlet	3 feet (91 cm) above if within 10 feet (3 m) horizontally	6 feet (1.83 m)
L=	Clearance above paved sidewalk or paved driveway located on public property	Vent termination not allowed in this location for category IV appliances.	7 ft (2.1 m) See note 5
M=	Clearance under veranda, porch, deck, or balcony	See note 4	12 inches (30 cm) (see note 3)

Notes:

1. In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code.
2. In accordance with the current CAN/CSA-B149.1 Installation Codes.
3. Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
4. 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.
5. For clearances not specified in CAN/CSA-B149, 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 12” above expected snow line. Local codes may have more specific requirements, and must be consulted.

Table 4. Direct Vent Clearances

4.5.2 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.

⚠ NOTICE

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

⚠ AVIS

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

4.6 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

⚠ 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 sécheuses, 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

4.7 Air Supply and Vent Connections

Combination Boiler Model	3″ Combustion Air / Vent Pipe	2″ Combustion Air / Vent Pipe
	Max	Max
FTCF140/199	100´ (30M)	50´* (15M*)

Table 5. Maximum Vent / Air Pipe Lengths for either 3" or 2 " Pipes

*Propane models are limited to 25 equivalent feet of 2" vent

NOTE: For each elbow, reduce maximum allowable length
- 5 feet (1.5M) for each 3-inch 90-degree elbow
- 2.5 feet (0.75M) for each 3-inch 45-degree elbow
- 8 feet (2.4M) for each 2-inch 90-degree elbow
- 4 feet (1.2M) for each 2-inch 45-degree elbow
- Max. 6 elbows for 3" vent, Max 4 elbows for 2" vent

NOTE: When using a 2" vent pipe, DIP Switch 4 must be in the OFF position. For 3" Pipe vent, the default setting for DIP 4 is ON. Refer to Section 4.19

4.7.1 Direct Venting

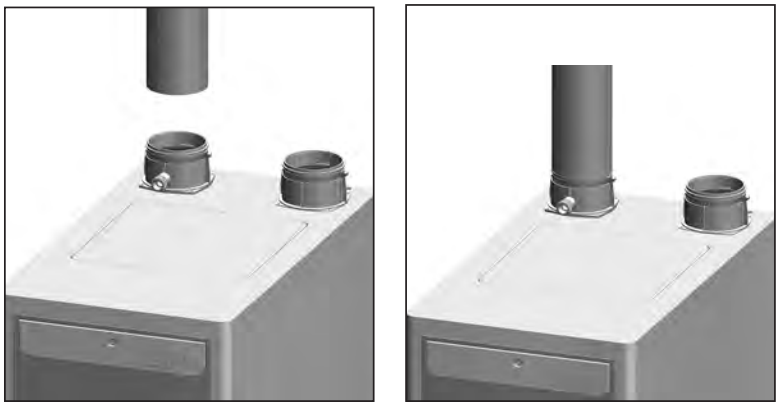
The boiler uses 3″ or 2″ diameter exhaust and 3″ or 2″diameter intake air ducts. To avoid leakage, use sealed venting and intake pipe.

(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.

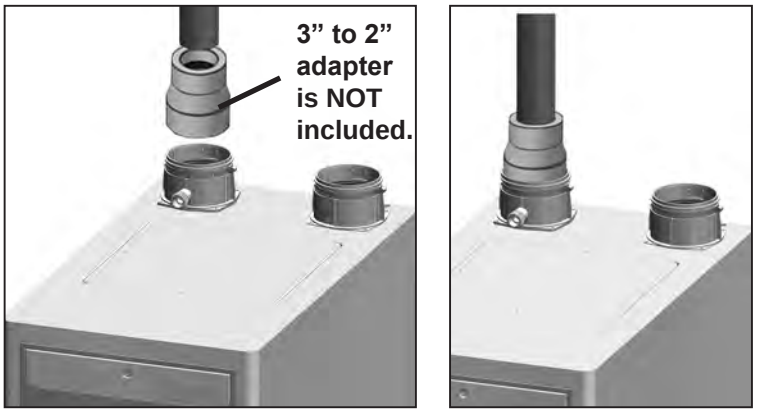
- **Tightening — Boiler Collar (Socket) to Vent Pipe & Inlet Pipe**
  - Clean and dry your selected PVC, CPVC vent pipe and boiler collar (socket).
  - You can select to the size of vent pipe(2″ & 3″), according to the installation conditions.
  - Push the pipe into the collar (socket) until it touches the bottom of the socket fitting.
  - For 2" installations, install using the supplied 3" to 2" adaptor. Adaptor must be installed in vertical section of piping only.

Shown is the FTCF**140**. The inlet and outlet are reversed on the FTCF**199**.

3" pipe



2" pipe connected, using an adapter



4.7.2 Indoor Combustion Air

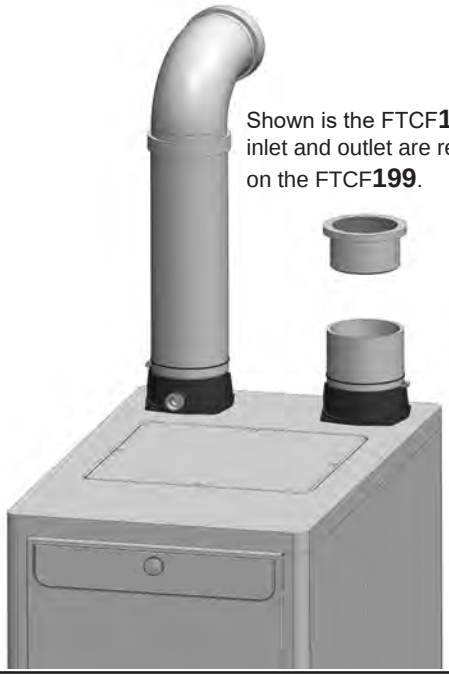
Read and Follow Section 4.3 Guidelines First.

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

Model	FTCF140	FTCF199
Maximum Input (BTU/H)	140,000	199,000
If indoor make up air is provided, a minimum free area of 1 in^2 per 1,000 BTU/H	140 in^2 13 1/4" (W) x 13 1/4" (H)	199 in^2 13 1/4" (W) x 13 1/4" (H)

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



Shown is the FTCF**140**. The inlet and outlet are reversed on the FTCF**199**.

4.8 Vent / Air Pipe Termination

All Terminations:

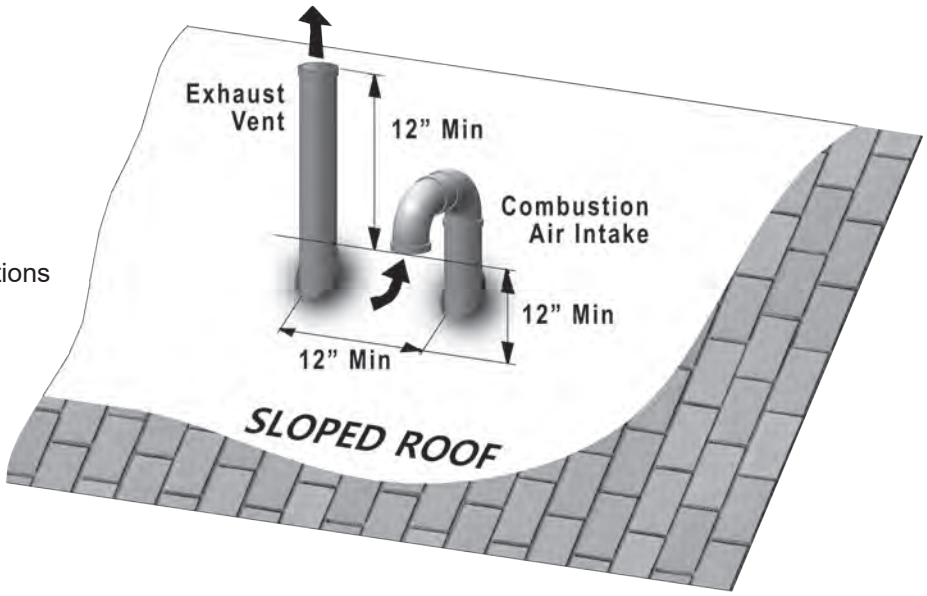
- After connecting the terminals, install vent screens on both the vent and air inlet.

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

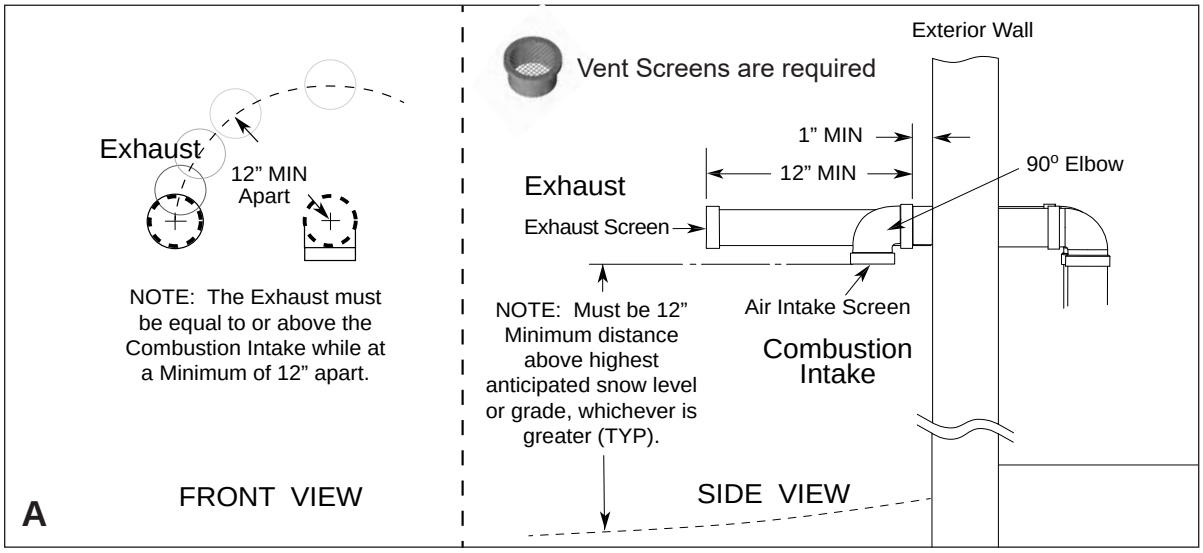
- Direct Vent - Vertical Terminations with Sloped Roof

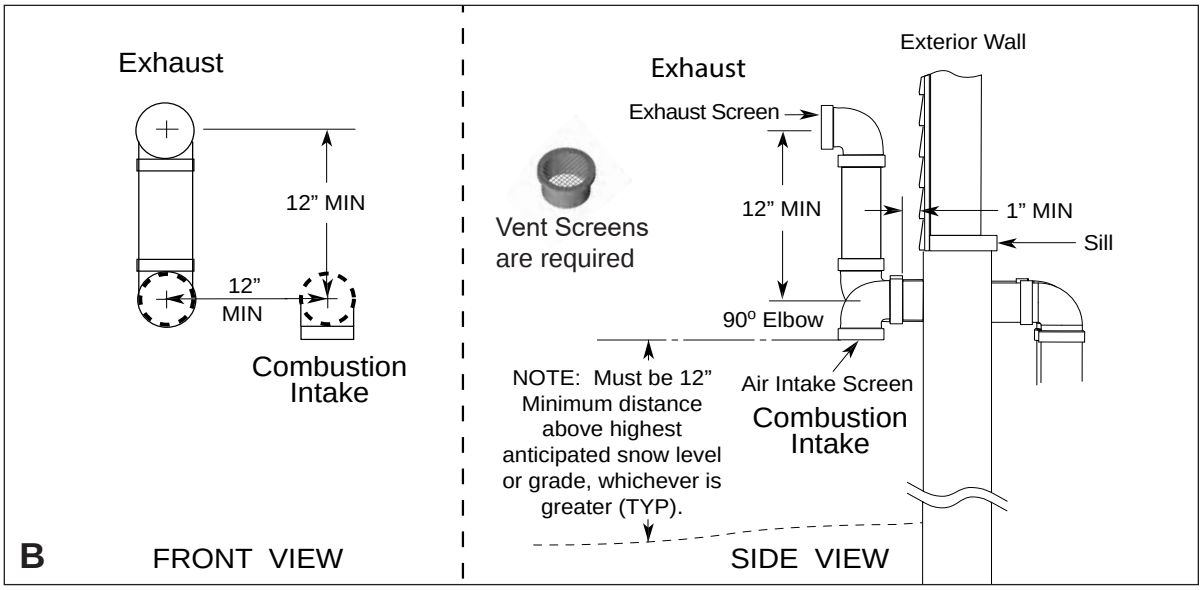


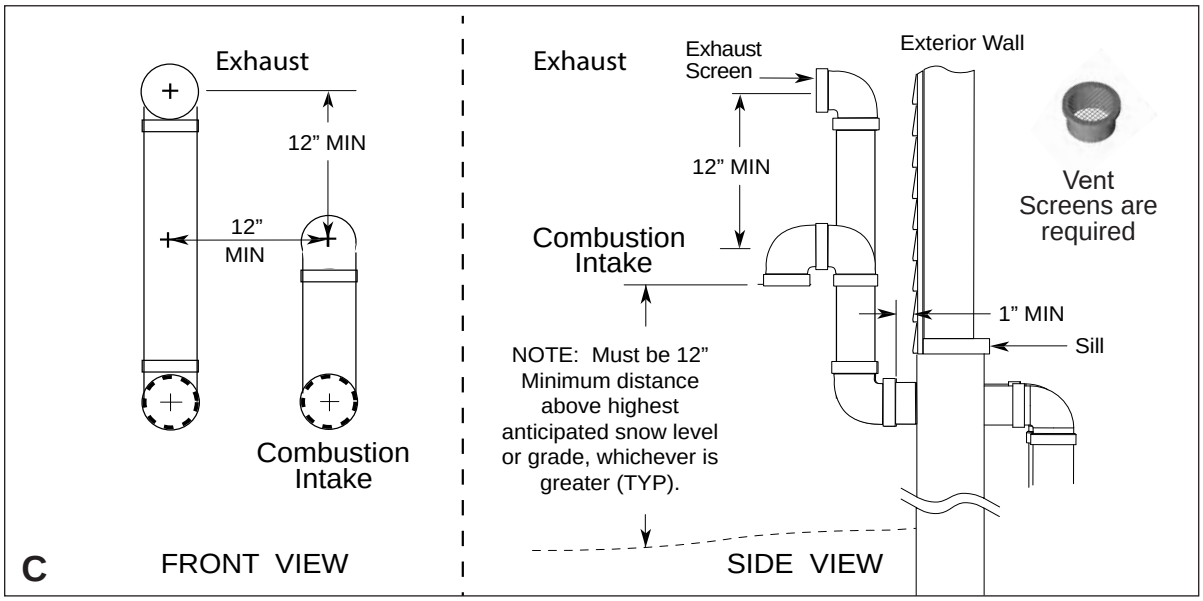
Vent Screens are required

Horizontal Vent Termination

- **Direct Vent - Sidewall Termination**



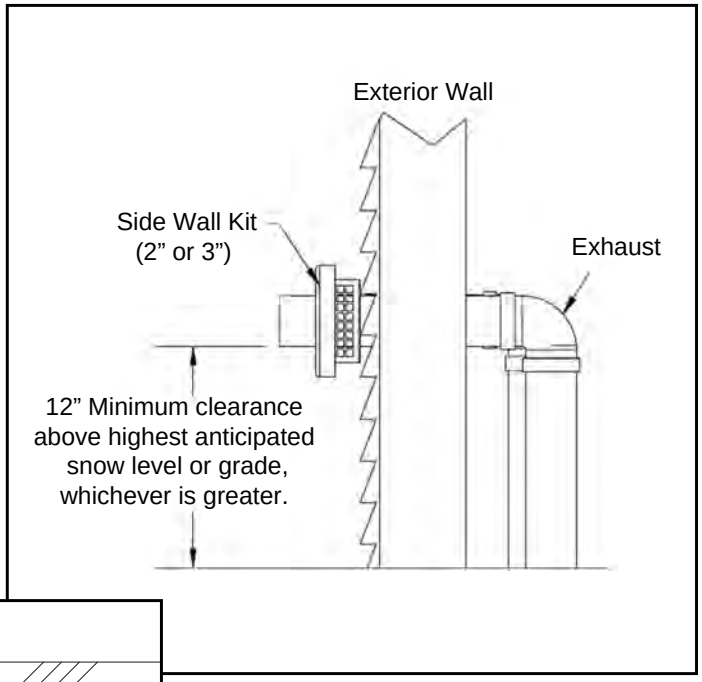


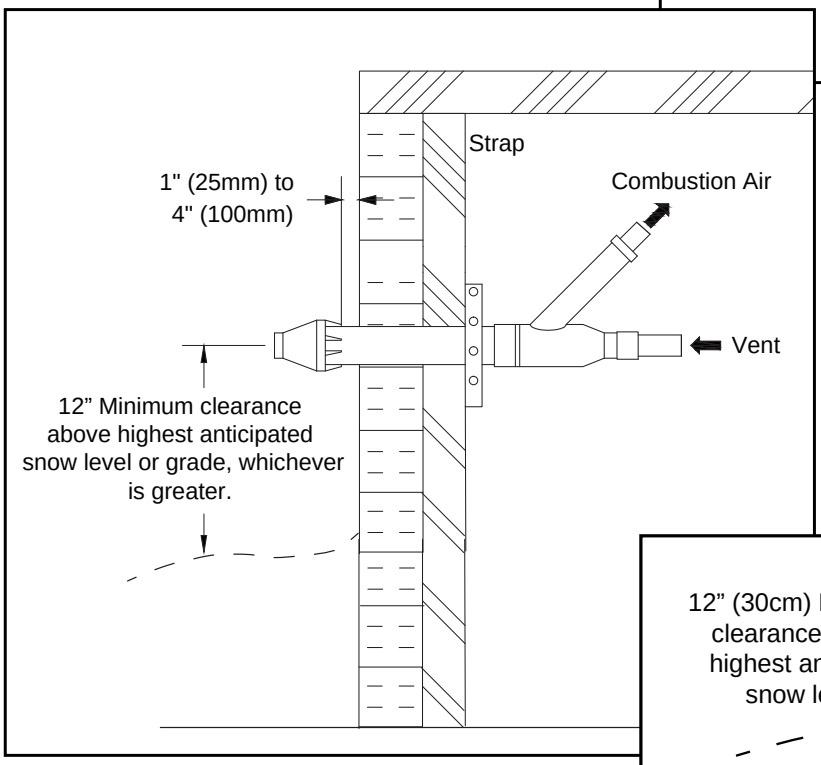


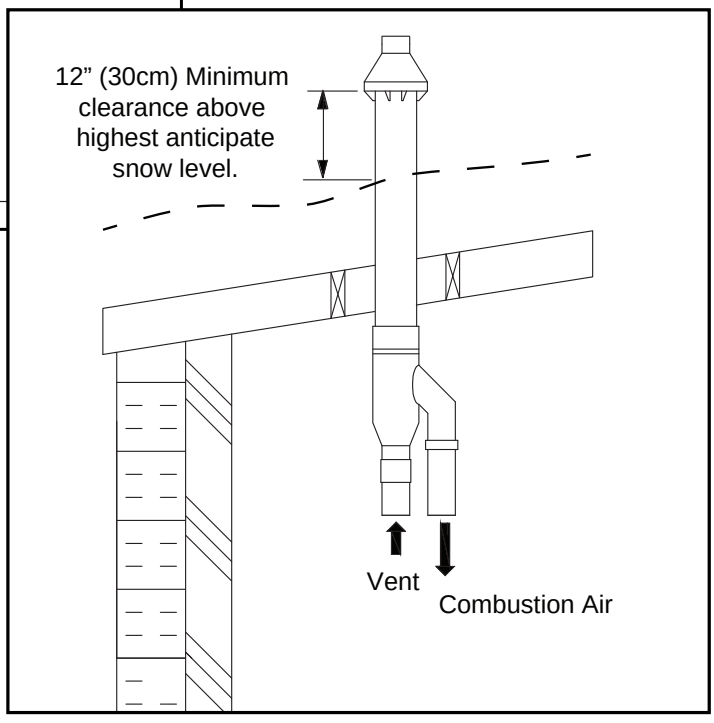
4.8 Vent / Air Pipe Termination (continued)

Concentric Vent Termination

- Direct Vent - Optional Horizontal and Vertical Concentric Vent







4.9 Gas Supply and Piping

Gas piping should be supported by suitable hangers or floor stands, not 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 4.12 for High Altitude Settings.
2. For minimum and maximum gas supply pressures. See Section 2.2 on page 6
3. Refer to Table 6, Table 7, and Table 8 to size piping.
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 less 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 top of boiler outlet to PRV, with no valves between. Refer to Section 4.15

⚠ ATTENTION

PRV (inclus) doit être installé immédiatement en haut de la chaudière sortie de PRV, sans les vannes entre. Se reporter à la Section 4.15

⚠ 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.

SCHED 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 HOUR	MAXIMUM CAPACITY IN THOUSANDS OF BTU PER		
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

- The gas connection fitting on the unit is 1/2”(FTCF140) or 3/4”(FTCF199) male NPT.

- 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 sizes of the supply line according to the COMBINED total maximum BTUH draw for the appliances as if they were all operating at the same time.

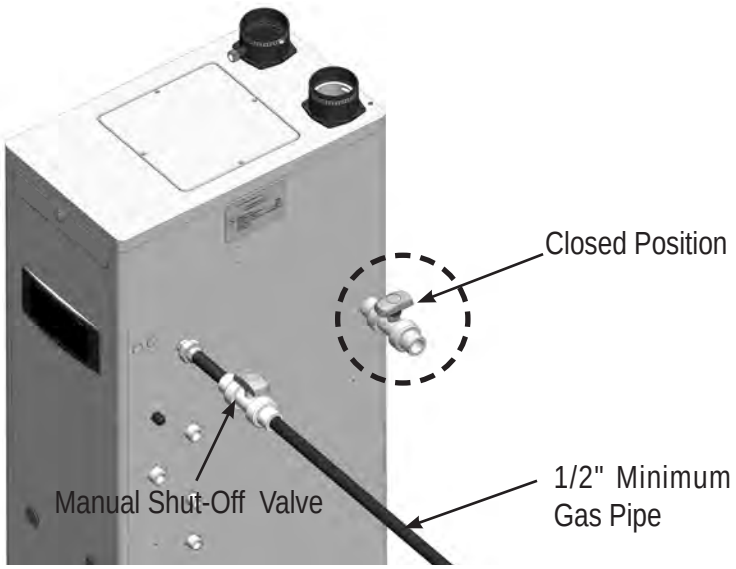
- Measure the length of the gas supply line from the gas meter to the Combination boiler. Use the tables in this manual or refer to the gas line manufacturers sizing information to determine the correct supply pipe size.

- The gas shut-off valve in the gas supply line should be installed close to the unit.

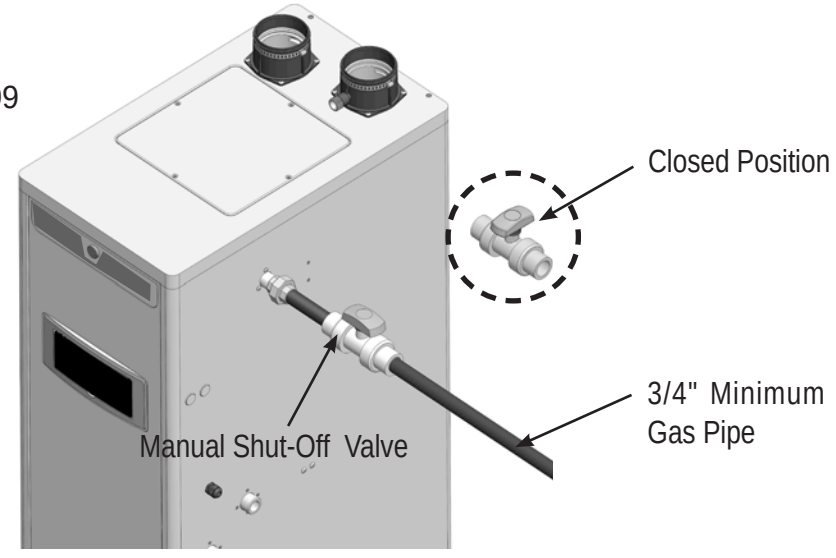
- To facilitate any future maintenance, it is also recommended that an approved gas union fitting be installed in the supply line between the shut-off valve and the 3/4” male NPT connection on the Combination boiler.
  1) Install an approved gas line pipe to gas line connection to the combination boiler. Include manual shut off valve and gas union 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 and the heat exchanger is filled with water.

FTCF140

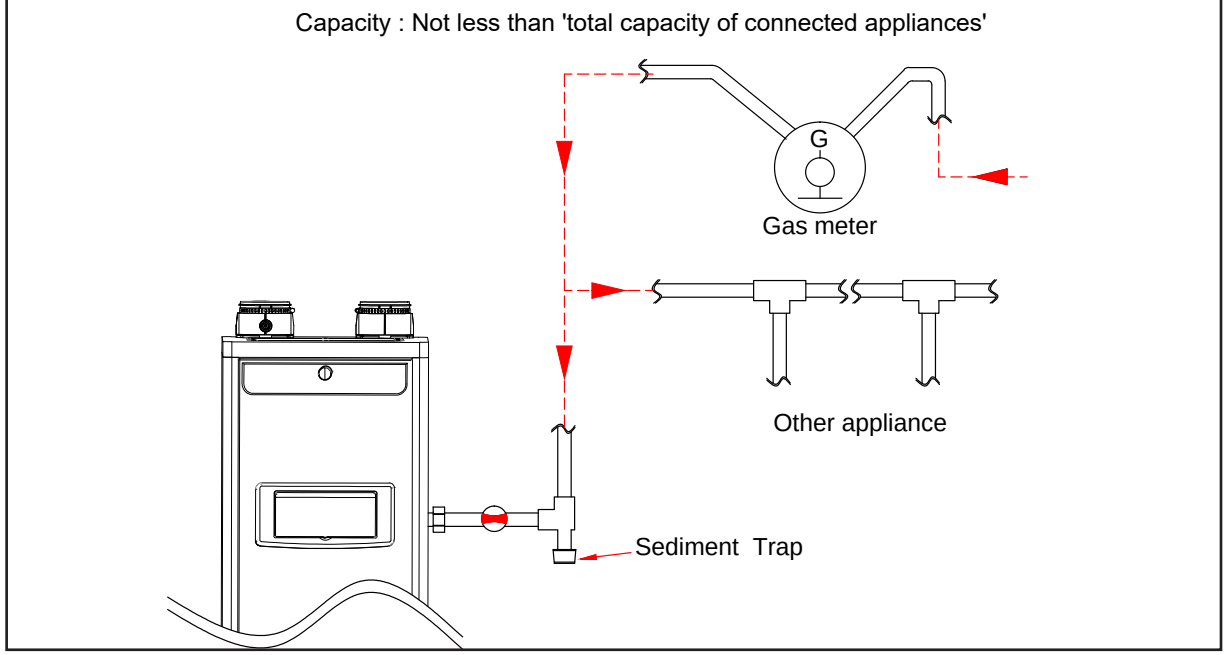


FTCF199

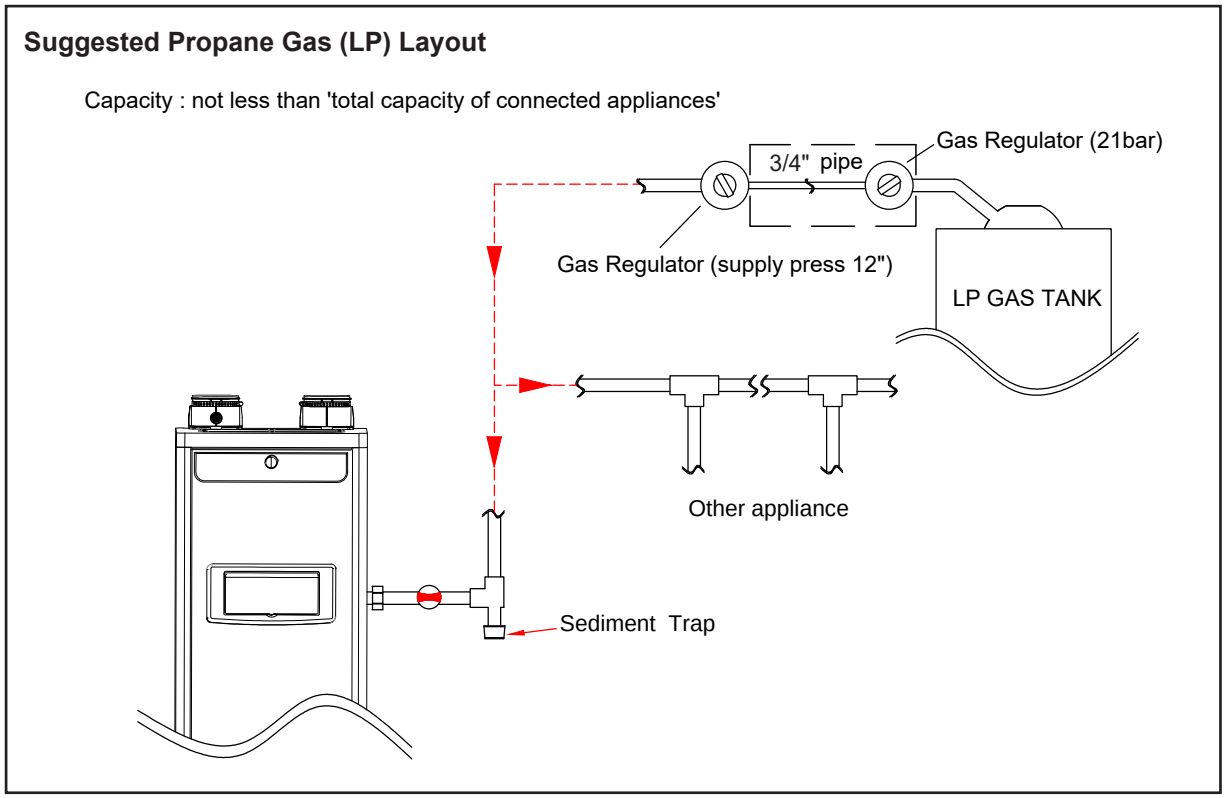


- Combination boiler must be installed downstream of the gas meter for adequate gas supply.
- Combination boiler gas connection pipe not less than a 1/2” (FTCF140) or 3/4” (FTCF199).

Suggested Natural Gas (NG) Layout



Suggested Propane Gas (LP) Layout



4.10 Gas Supply Pressure

- The minimum and maximum inlet gas line pressures must be

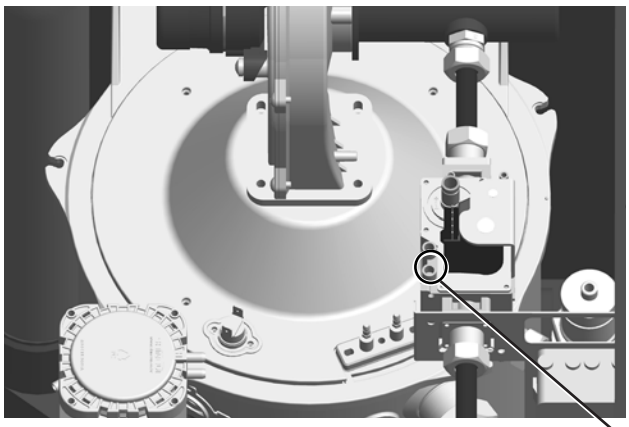
LP Gas		Natural Gas	
Maximum Pressure	13.0" WC	Maximum Pressure	10.5" WC
Minimum Pressure	8.0" WC	Minimum Pressure	3.5" WC

⚠ CAUTION

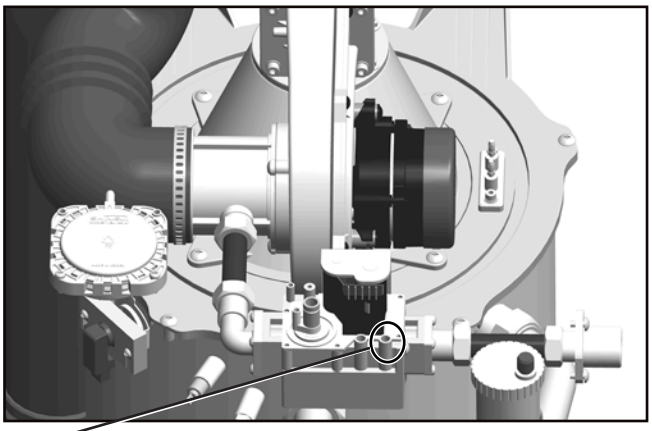
- The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of the system at test pressures in excess of 1/2 psi (3.5 kPa).

- The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or greater than 1/2 psi (3.5 kPa).

- Loosen the pressure port bolts before you check the gas inlet pressure.



FTCF140



FTCF199

Inlet Gas Pressure Port

4.11 Gas Adjustment

1. Turn ON the GAS and WATER supply to the FT.
2. Remove water heater cover by loosening the 4 screws that hold the cover in place.
3. Turn ON the FT.
4. Ensure your Mascot FT is set for the correct altitude. The default setting is for altitudes of 0~1,999 ft above sea level. If your Mascot FT is installed at an altitude of 2,000 ft,or greater the correct altitude setting should be set according to Section 4.12 of the Mascot FT Install and Operating Manual before continuing with tuning.

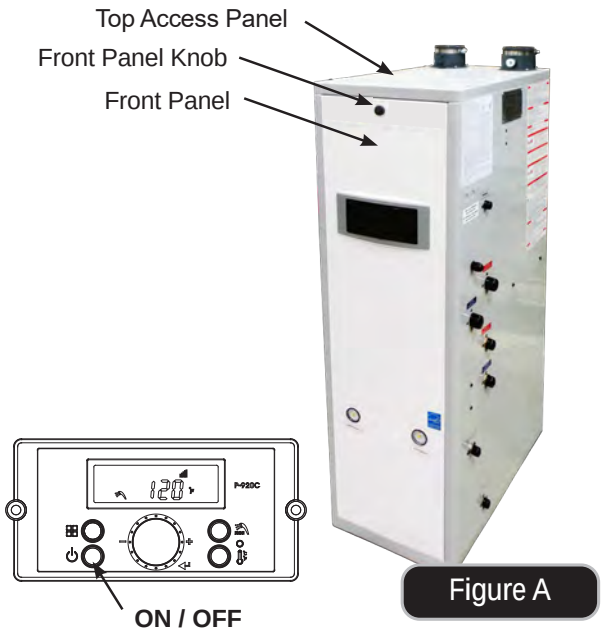


Figure A

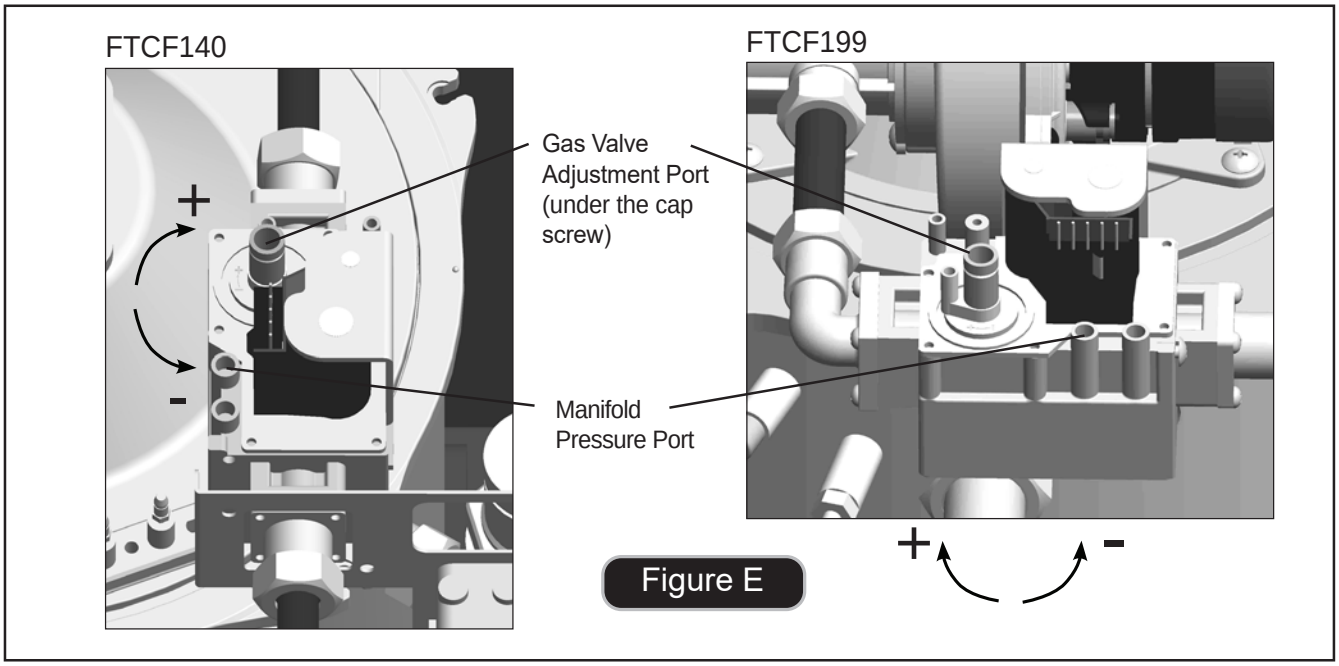


Figure E

5. Connect a manometer to the Manifold Pressure Port. See Figure E. For dual port manometers, use the positive pressure side. Check for proper manifold gas pressure. Refer to Table C on page 34.

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. Setup your combustion analyzer and place the sensor into the combustion test port.

8. Per Table B (below) for Max Fire, change DIP switch 6 to ON and 7 to OFF. The unit will cycle up to MAX fire

ON	OFF
MIN Fire	Normal Operation
MAX Fire	Normal Operation
NG Natural	LP Propane
3" Vent Size	2" Vent Size

ON	OFF	ON	ON
ON	OFF	OFF	ON
OFF	ON	ON	ON
MBH	140		199

Table B DIP Switch Settings

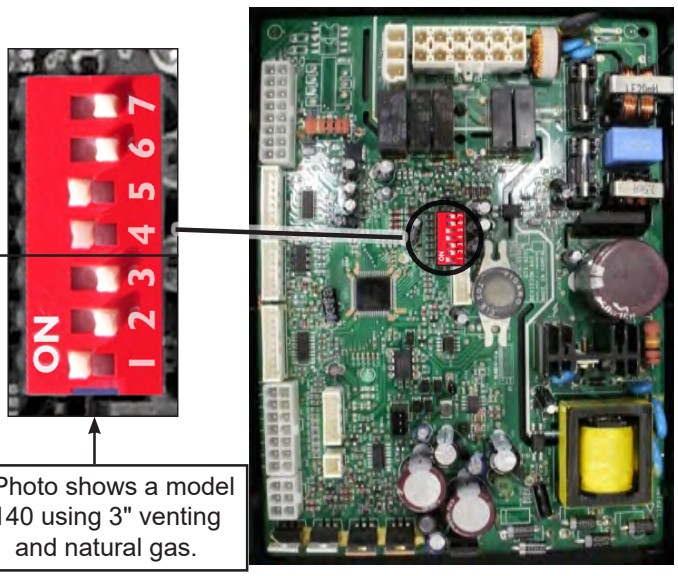


Photo shows a model 140 using 3" venting and natural gas.

Figure D

4.11 Gas Adjustment (continued)

Manifold pressure		Gas Type 'NG'		Gas Type 'LP'	
		2" VENT	3" VENT	2" VENT	3" VENT
FTCF140	MAX Fire	-0.15" WC	-0.216" WC	-0.15" WC	-0.216" WC
	MIN Fire	0" WC	0.002" WC	0.1" WC	0.079" WC
FTCF199	MAX Fire	-0.134" WC		-0.173" WC	
	MIN Fire	-0.015" WC		-0.015" WC	

Table C

CO_2 value		Gas Type 'NG'		Gas Type 'LP'	
		2" VENT	3" VENT	2" VENT	3" VENT
FTCF140	MAX Fire	8.5~10.5%		9.5~11 %	
	MIN Fire	8~10%		9~10.5 %	
FTCF199	MAX Fire	8.5~10.0%		9.5~11 %	
	MIN Fire	8~10%		9~10.5 %	

Table D

9. WAIT for your combustion analyzer to stabilize. This may take up to 3 minutes depending on your combustion analyzer. Then check the CO_2 measurement for MAX fire. Refer to Table D for acceptable MAX fire combustion readings. At this point, just record the CO_2 readings at MAX Fire.
   Do NOT adjust CO_2 at MAX Fire.

   Only adjust CO_2 in Min Fire operation. Refer to Table D for acceptable MAX fire combustion readings.

10. Change to MIN Fire operation per Table B, change dip switch 6 to OFF and 7 to ON. The unit will cycle down to MIN Fire.

11. WAIT for your combustion analyzer to stabilize. Then check the CO_2 measurement at MIN fire. Refer to Table D for acceptable MIN fire combustion readings.

12. If CO_2 readings in Max Fire and MIN fire are acceptable, then skip ahead to Step 13. If not, then open the Gas Valve Adjustment Port by removing the cap screw with a 4mm Allen wrench. See Figure E.

13. Then use the 4 mm Allen wrench to make a minor adjustment (1/8 turn) to either increase or decrease CO_2.

14. It may be necessary to go back and forth between HI Fire and LOW Fire several times (and adjusting ONLY at LOW Fire), before CO_2 at both are within acceptable levels. Be sure to put the cap screw back onto the gas valve adjustment port when done.

15. Once the CO_2 and manifold pressure measurements for both MIN and MAX Fire are acceptable per Table D, set DIP switches 6 and 7 to the OFF position for Nominal Fire (normal operation). The FT is now operating in its normal mode.

16. Remove your combustion analyzer from the combustion test port and be sure to thread the test port plug back into position.

17. Re-connect outdoor reset if it was disconnected previously in this conversion and put the Front Panel and Top Access Panel back on. Tighten them into place using the 4 fasteners that you loosened in step 2.

4.12 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 does have 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.

#	Altitude of Installation
0	0~1999 ft (0~609 m)
1	2,000~4,499 ft (610~1,645 m)
2	4,500~7,699 ft (1,646~2,346 m)
4	7,700~10,000 ft (2,347~3,048 m)

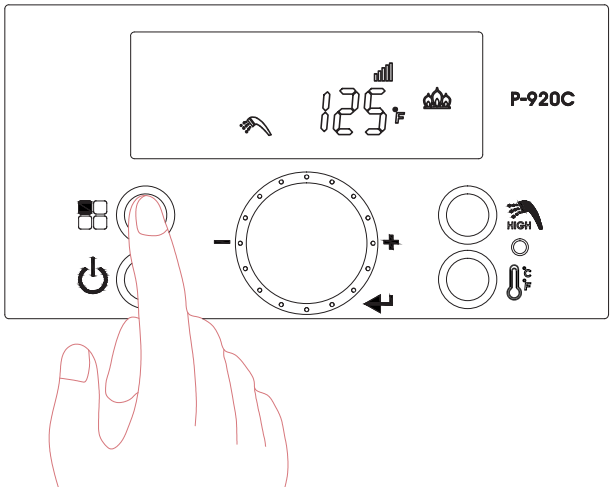
2. Turn the dial (E) until '**28:HA**' appears.

3. Press the dial (E).

4. Set the high altitude value by turning the dial. Refer to table.

5. Press the dial again (E) to save the setting.

6. Press the 'Modes button' ⊞ for one second, to Save the number and to go back to initial status.



4.13 Natural Gas to Propane Conversion

The FT Series, Floor-Standing, Gas Conversion Kit Document 4290C

Kit # R20771

The FT Series, floor standing, condensing boiler is configured for Natural Gas (NG) from the factory. A Natural Gas to 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.

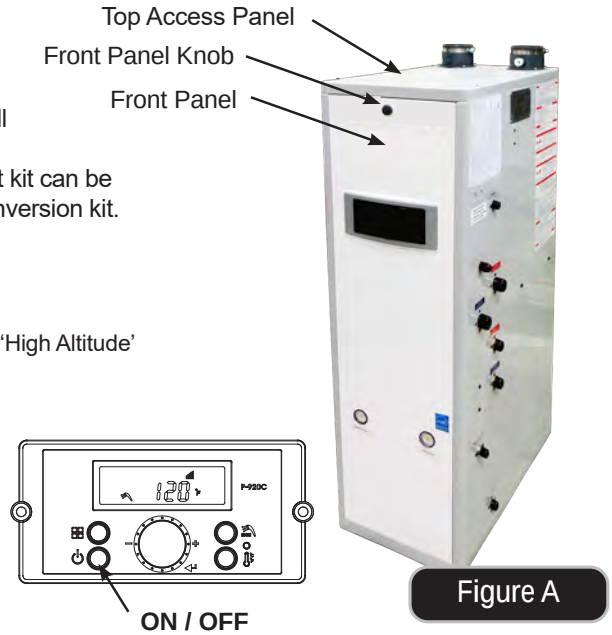


Figure A

⚠ NOTICE

If your installation altitude is greater than 2000 ft, please check that the 'High Altitude' Installer Setting has been adjusted to suit your installation altitude.

⚠ CAUTION

This combination 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 your fuel source is natural gas. Or verify that your fuel source is propane if you are converting this combination unit to propane.

Steps 1 thru 26

To convert from Natural Gas to Propane Gas

1. Turn **OFF** the FT. The **ON / OFF** button is located at the bottom left of the Control Display.
2. Turn **OFF** the GAS and WATER supply to the FT (valves are located on the plumbing pipes.)

	Natural Gas (NG) Part #	Propane Gas (LP) Part #
FTCF140	FT1412N5	FT1412P5
FTCF199	FT1780	FT1802

Gas Conversion Part Numbers

Nozzle

Orifice

⚠ WARNING

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.

⚠ AVERTISSEMENT

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.

4.13 Natural Gas to Propane Conversion (continued)

The FT Series, Floor-Standing, Gas Conversion Kit Document 4290C

3. Using a Phillips screwdriver, remove the 4 screws on the Top Access Panel, and then lift out the Top Access Panel.
4. Unthread the Front Panel Knob at the top of the front panel and then remove the entire panel. See Figure A.
5. With the internal components exposed, locate the gas inlet pipe of your model. See Figure B.

Figure B

6. Loosen the hex-nuts on the Gas Inlet Pipe and remove the nozzle or orifice (See Figure C). Save the Packing for re-use with the replacement Gas Orifice.

Figure C

7. Remove the existing natural gas nozzle or orifice. If your unit is a FTCF199, note that the conical end of the orifice is towards the valve. Save the packing for re-use. See Figure C.
8. Replace the old Nozzle (or Orifice) with the new one for LP (propane). Re-use the packing from previous.
9. Return the Gas Inlet Pipe to its original position and tighten the Brass Fittings.
10. Per **Table B**, set DIP Switch **5 to the 'OFF' setting (the #5 DIP switch setting for** LP Propane is the OFF side).
11. Turn **ON** the GAS and WATER supply to the FT.
12. Turn **ON** the FT.
13. Connect a manometer to the Manifold Pressure Port. See Figure E. For dual port manometers, use the positive pressure side. Check for proper manifold gas pressure. Refer to Table C on next page.
14. Establish a call for heat. You may need to disconnect the outdoor reset if you are making this gas conversion during warm weather.

4.13 Natural Gas to Propane Conversion (continued)

ON	OFF
MIN Fire	Normal Operation
MAX Fire	Normal Operation
NG Natural	LP Propane
3" Vent Size	2" Vent Size

ON	OFF	ON	ON
ON	OFF	OFF	ON
OFF	ON	ON	ON
MBH	140		199

Table B DIP Switch Settings

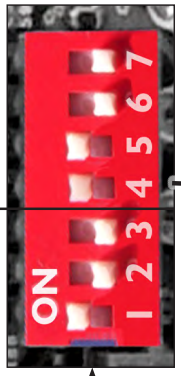


Photo shows a model 140 using 3" venting and natural gas.

Figure D

15. Setup your combustion Analyzer and place the sensor into the combustion test port.
16. Per **Table B for Max Fire**, change dip switch 6 to ON and 7 to OFF. The unit will cycle up to MAX fire.
17. WAIT for your combustion Analyzer to stabilize. This may take up to 3 minutes depending on your combustion Analyzer. Then check the CO_2 measurement for MAX fire. Refer to Table D for acceptable MAX fire combustion readings. At this point, just record the CO_2 readings at MAX Fire. Do NOT attempt to adjust CO_2 at MAX Fire. ONLY in MIN Fire, so...
18. Per **Table B for MIN Fire**, change dip switch 6 to OFF and 7 to ON. The unit will cycle down to MIN Fire.
19. WAIT for your combustion Analyzer to stabilize. Then check the CO_2 measurement at MIN fire. Refer to Table D for acceptable MIN fire combustion readings.
20. If CO_2 readings in Max Fire and MIN fire are acceptable, then skip ahead to Step 23. If not, then open the Gas Valve Adjustment Port by removing the cap screw with a 4mm Allen wrench. See Figure E.
21. Then use the 4 mm Allen wrench to make a minor adjustment (1/8 turn) to either increase or decrease CO_2.

Manifold pressure		Gas Type 'NG'		Gas Type 'LP'	
		2" VENT	3" VENT	2" VENT	3" VENT
FTCF140	MAX Fire	-0.15" WC	-0.216" WC	-0.15" WC	-0.216" WC
	MIN Fire	0" WC	0.002" WC	0.1" WC	0.079" WC
FTCF199	MAX Fire	-0.134" WC		-0.173" WC	
	MIN Fire	-0.015" WC		-0.015" WC	

Table C

CO_2 value		Gas Type 'NG'		Gas Type 'LP'	
		2" VENT	3" VENT	2" VENT	3" VENT
FTCF140	MAX Fire	8.5~10.5%		9.5~11 %	
	MIN Fire	8~10%		9~10.5 %	
FTCF199	MAX Fire	8.5~10.0%		9.5~11 %	
	MIN Fire	8~10%		9~10.5 %	

Table D

4.13 Natural Gas to Propane Conversion (continued)

The FT Series, Floor-Standing, Gas Conversion Kit Document 4290C

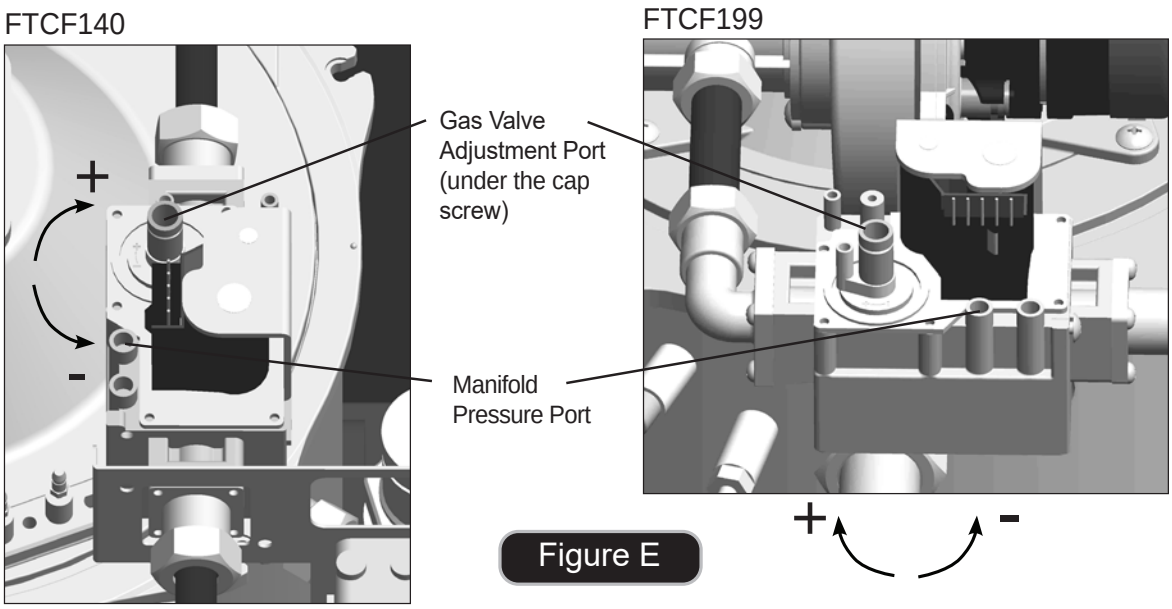


Figure E

22. It may be necessary to go back and forth between HI Fire and LOW Fire several times (and making adjustments ONLY at LOW Fire), before CO_2 at both are within acceptable levels. Be sure to put the cap screw back onto the gas valve adjustment port when done.
23. Once the CO_2 and manifold pressure measurements for both MIN and MAX Fire are acceptable per Table D, set DIP switches 6 and 7 to the OFF position for Nominal Fire (normal operation). The FT is now operating in it's normal mode.
24. 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.
25. Remove your combustion Analyzer from the combustion test port and be sure to thread the test port plug back into position.
26. Re-connect outdoor reset if it was disconnected previously in this conversion and put the Front Panel and Top Access Panel back on. Tighten them into place using the knob and 4 fasteners that you disassembled in Step 3.

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)

4.14 Plumbing Guidelines

4.14.1 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 bottom connections of the unit.
- The size of the DHW pipe should be 3/4″ diameter and central heating water pipe should be 1″ diameter.
- Isolation valves(Shutoff valve) will be used.
- All piping should be insulated.

4.14.2 Applicable Backflow Preventer

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

4.14.3 Closed type Expansion tank

- Apply 1" pipe to the expansion tank to allow air within the system for exhausting.
- Pitch any horizontal piping up towards tank 1 inch per 5 feet of piping.
- DO NOT install automatic air vents on closed type expansion tank systems. Air must remain in the system and return to the tank to provide its air cushion.
- DO NOT use a closed type expansion tank in a system with the FT Combination Boiler. (Automatic air vent has been installed inside of the boiler.)
- If the combination boiler is installed in a closed water supply system, such as one having a backflow preventer in the cold water supply line, it will control thermal expansion.

4.14.4 Diaphragm Type Expansion Tank

- 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 (Under figure ‘A’)’ on the top of the air separator to remove residual air from the system.
- Automatic air vent has been installed on the inside of the FT combination boiler.
- The installation of additional air vent is optional.
- If the combination boiler is installed in a closed water supply system, such as one having a backflow preventer in the cold water supply line, it will control thermal expansion.
- Pump for primary loop is included with FT for ≤ 15 ft.

⚠ CAUTION

- Use at least the MINIMUM pipe size for the entire boiler loop piping (connecting boiler to and from the primary/secondary connection). Use only primary/secondary piping as shown.
  Failure to follow these guidelines could result in system problems.

- CH pipe minimum size : 1″

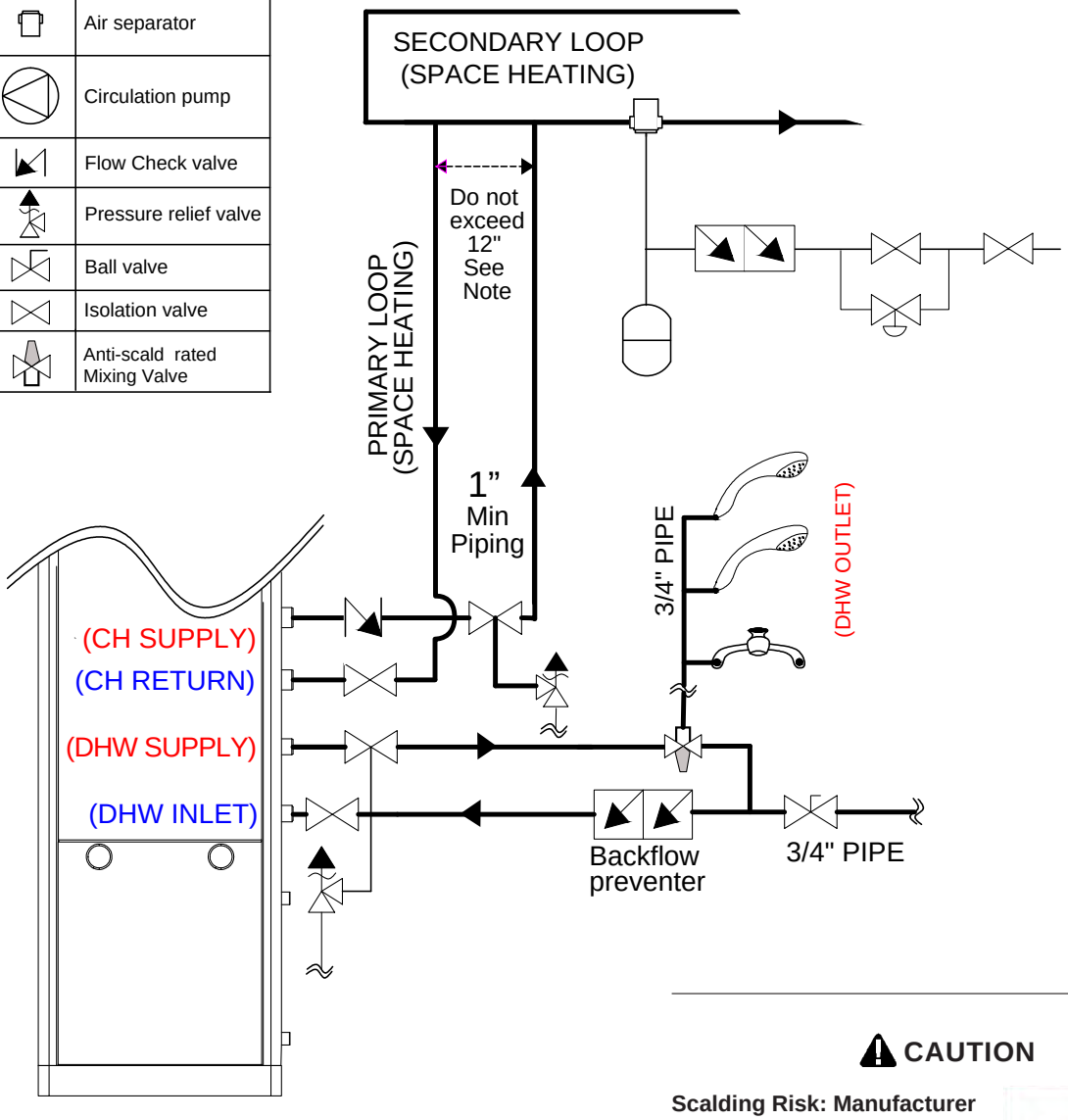
- DWH pipe minimum size : 3/4″

⚠ CAUTION

For guidelines in the use of Glycol Products.
Please refer to Section 8.3 on page 76

4.14 Plumbing Guidelines (continued)

	Diaphragm Type Expansion tank
	Air separator
	Circulation pump
	Flow Check valve
	Pressure relief valve
	Ball valve
	Isolation valve
	Anti-scald rated Mixing Valve



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

⚠ CAUTION

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

⚠ CAUTION

PRV (included) must be installed immediately at the top of boiler outlet to PRV, with no valves between. Refer to Section 4.15

⚠ ATTENTION

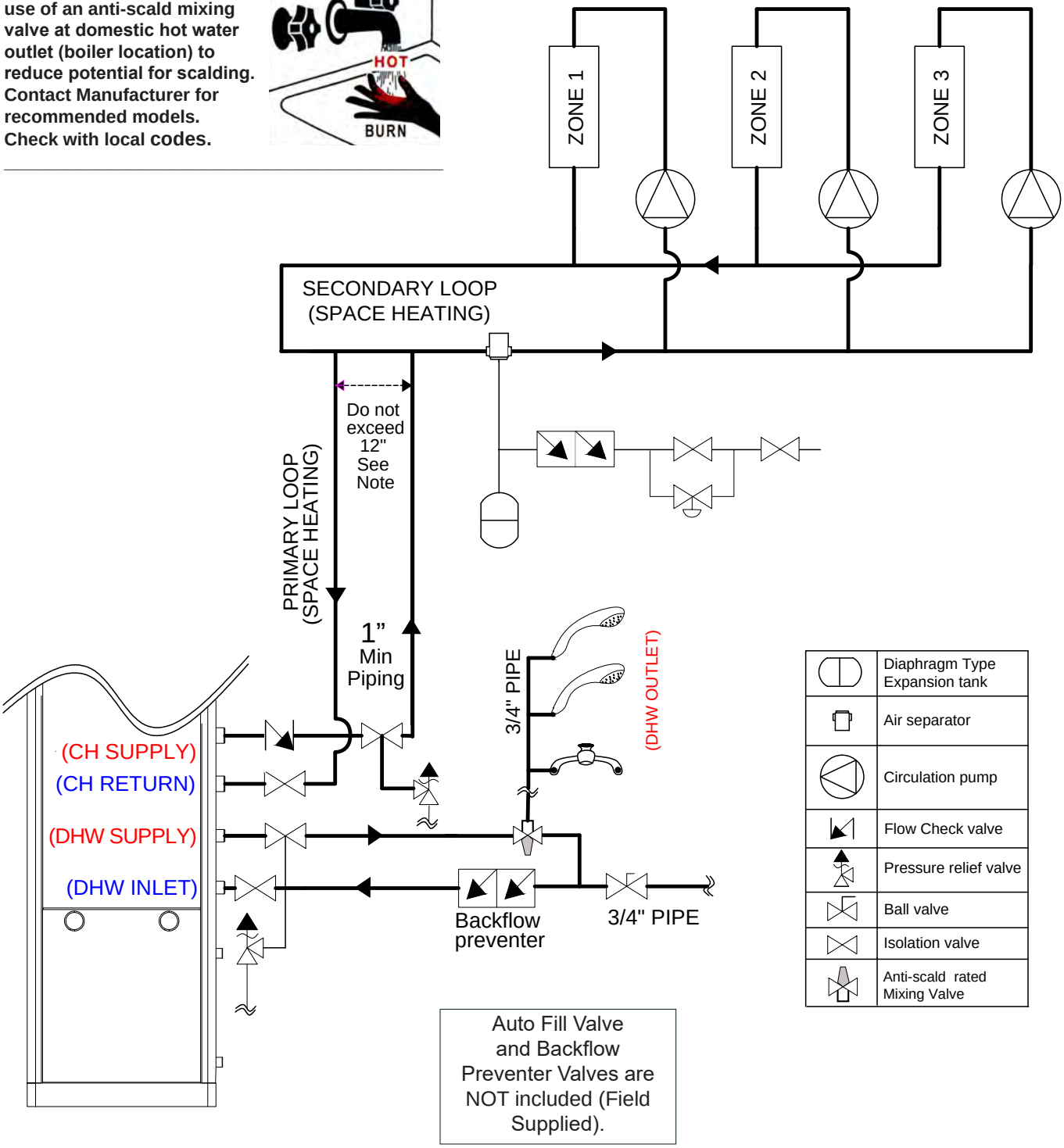
PRV (inclus) doit être installé immédiatement en haut de la chaudière sortie de PRV, sans les vannes entre. Se reporter à la Section 4.15

4.14.5 Zoning with Circulation Pumps

- Each heating zone of a pump based system has its own circulator pump which runs when the zone needs it.
- Each zone thermostat goes to a controller which controls the pumps.

⚠ CAUTION

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



4.14.6 Zoning with Zone Valves

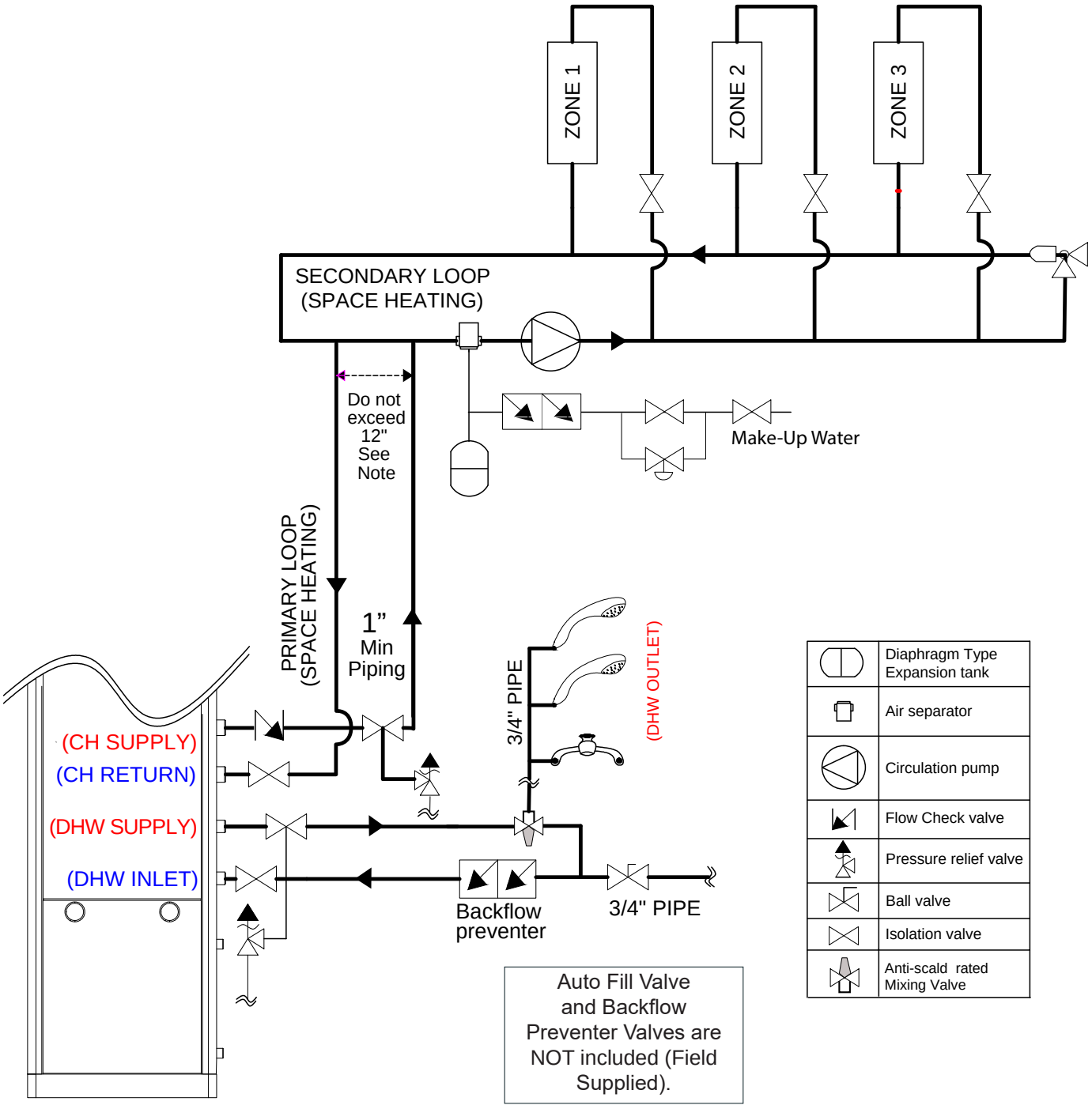
- In a valve based system, there is one circulator pump at the boiler and each heating zone has its own valve.
- Each thermostat is wired directly to the corresponding zone valve. Contacts in the zone valves provide a proper signal to the boiler when the valve is opened.

⚠ CAUTION

PRV (included) must be installed immediately at the top of boiler outlet to PRV, with no valves between. Refer to Section 4.15

⚠ ATTENTION

PRV (inclus) doit être installé immédiatement en haut de la chaudière sortie de PRV, sans les vannes entre. Se reporter à la Section 4.15



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

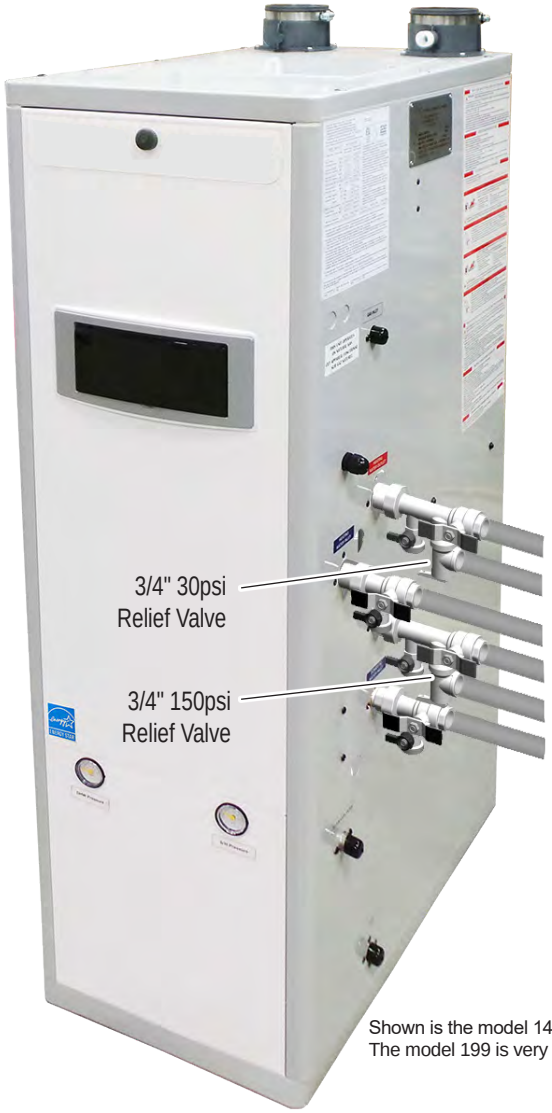
4.15 Pressure Relief Valves

- 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 combination boiler before installing a Pressure Relief Valve (PRV) that is rated in accordance with the ASME Rating Plate on the boiler.

- This hot water boiler is provided with 30 psi safety relief valve that complies with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV (“Heating Boilers). (Model : CASE ACME F-82)
- This safety relief valve (30 psi) is shipped loose for field installation.
- An approved ASME HV Pressure Relief Valve must be installed on the DHW supply line as close to the unit as possible. Valve size 3/4”, maximum 150 psi. Not included with boiler.
- For safety, the relief valve(s) must be installed into it’s designed 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 so that hot water will not splash on anyone or any nearby equipment. Attach the discharge line to the pressure relief valve and run the end of the line within 6-12″ (150-300mm) of the floor.



Shown is the model 140.
The model 199 is very similar.

⚠ WARNING

- DO NOT install a CH pipe line relief valve with a pressure higher than 30psi and DHW pipe line relief valve with a pressure higher than 150psi. This is the maximum allowable relief valve setting for the combination 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 pressure rating of the combination 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 combination boiler.
- Pressure Relief Valve must be installed on the CH supply line & DHW outlet line as close to the unit as possible. (CH supply line: maximum 30psi, DHW outlet line : maximum 150psi). 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.

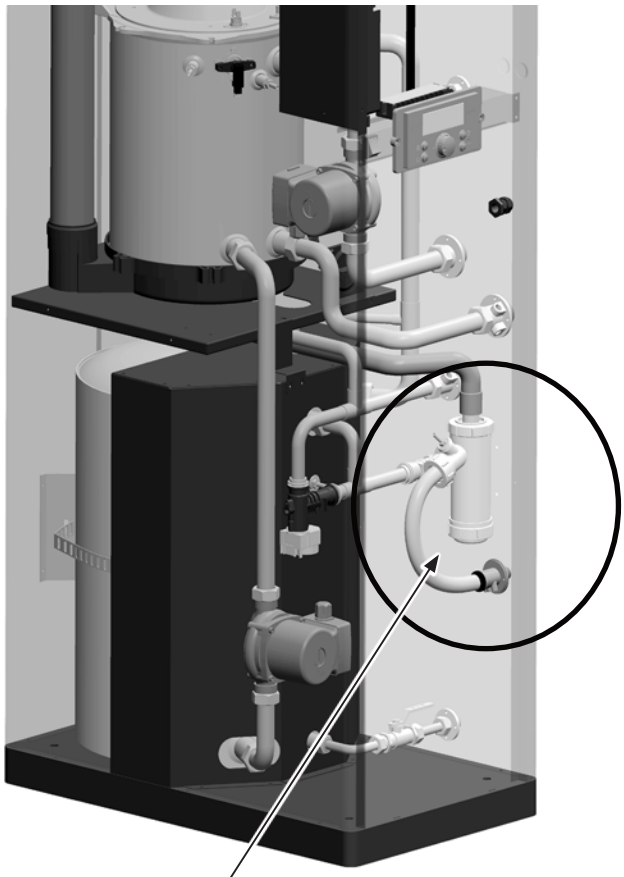
4.16 Disposal of Condensate

- High efficiency gas condensing Boilers create condensation when operating. Condensation has acidic (pH) of approximately 4-5.

- Condensate must be drained in accordance with all local regulations. Follow your local code with regards to the disposal of condensation.
  One of 4 disposal methods must be followed
  1. **to floor drain**
  2. **to neutralizer (optional kit)**
  3. **to laundry tub**
  4. **to 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.



Condensate Trap and Drain Pipe

(viewed from left front corner and as if the side and front panel are semi-transparent).

⚠ NOTICE

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

⚠ AVIS

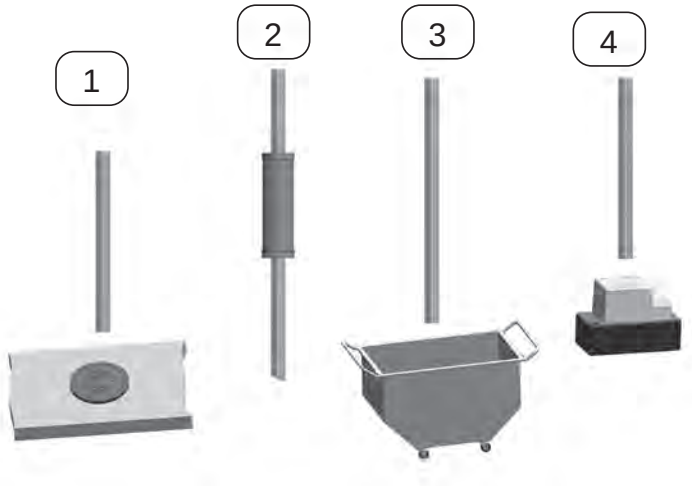
les chaudières de catégories II et IV doivent être installées de façon à empêcher l'accumulation de condensat; et

si nécessaire, les chaudières de catégories II et IV doivent être pourvues de dispositifs d'évacuation du condensat.

⚠ CAUTION

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.**

Contact the factory to order
Neutralizer Kit# A2123601

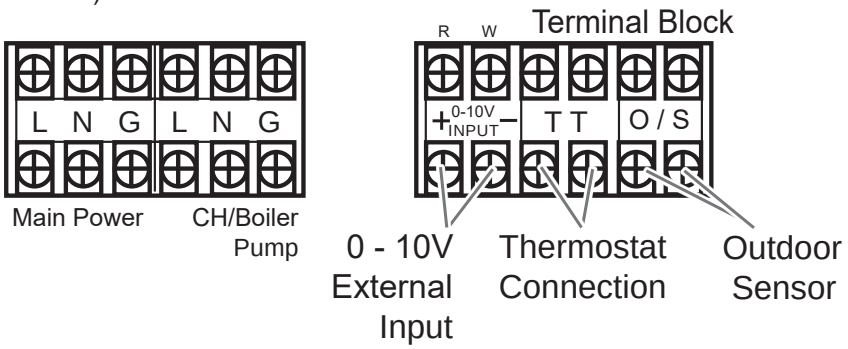


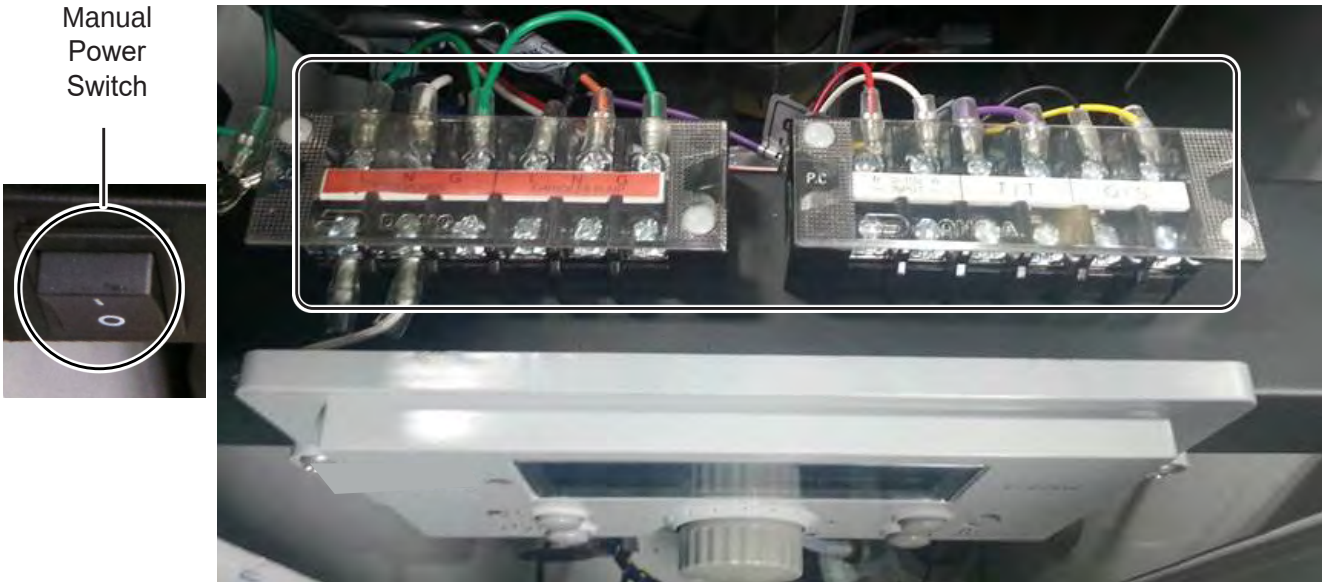
4.17 Electrical Wiring Connections

⚠ 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.
- 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 16 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)





4.18 DIP Switches

■DIP switches 6 and 7 have to be set in the OFF position when the boiler is running normally.

ON	OFF
MIN Fire	Normal Operation
MAX Fire	Normal Operation
NG Natural	LP Propane
3" Vent Size	2" Vent Size

ON	OFF	ON	ON
ON	OFF	OFF	ON
OFF	ON	ON	ON
MBH	140		199

Table B DIP Switch Settings

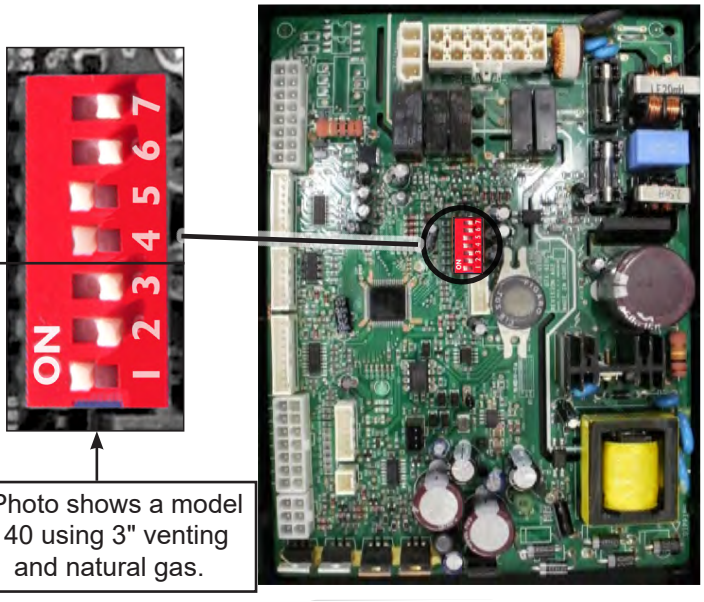
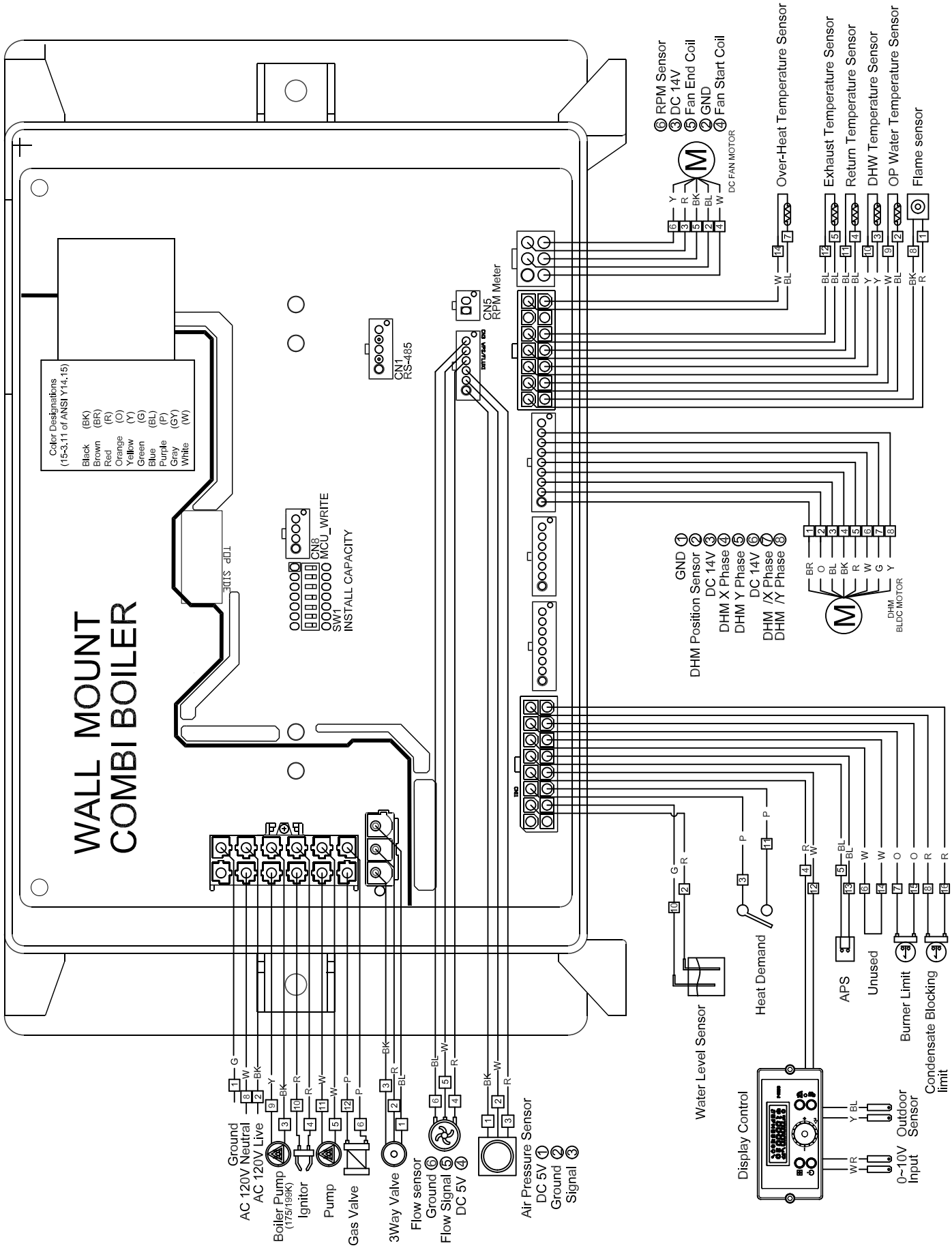


Photo shows a model 140 using 3" venting and natural gas.

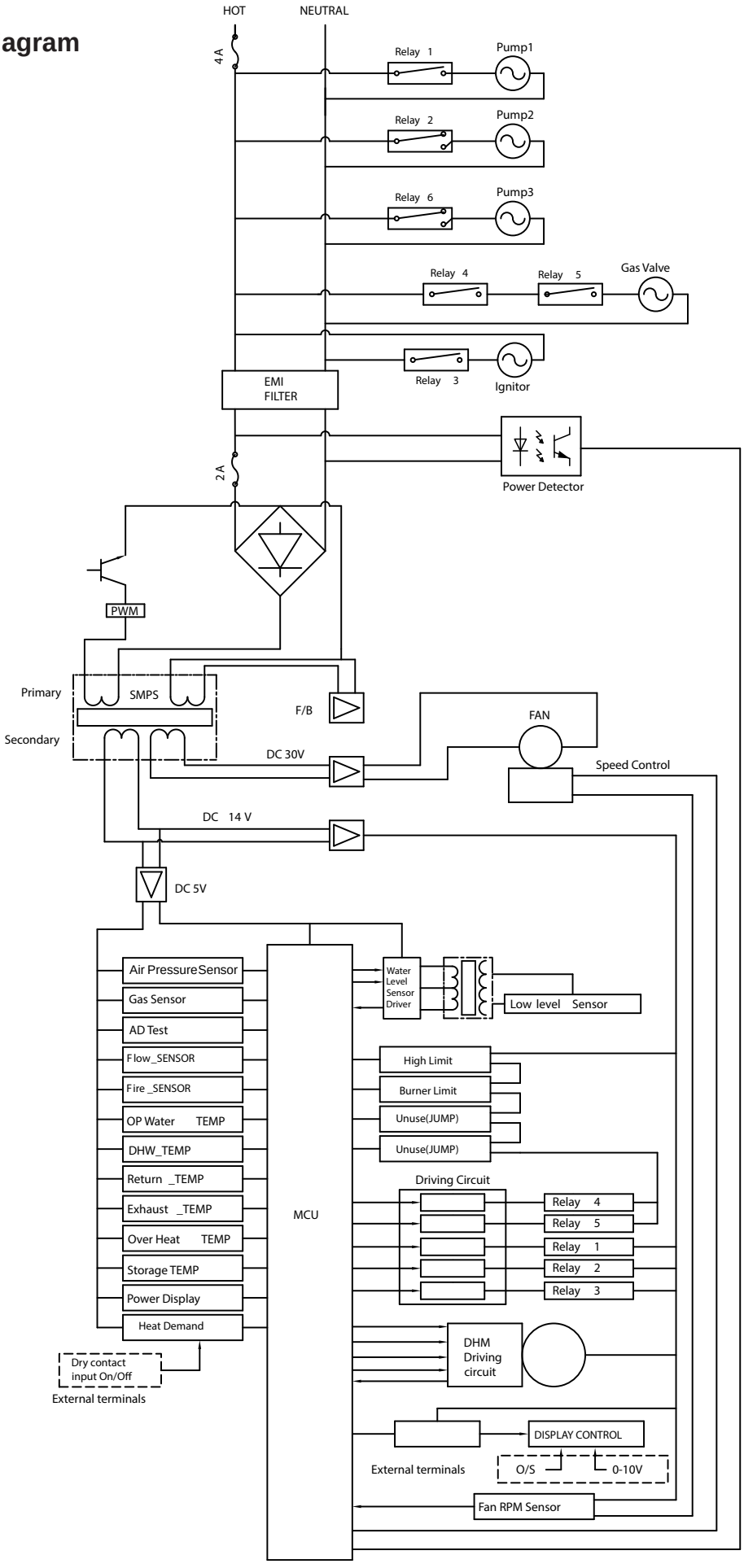
System Control Setting

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

4.19 Control Board, Electrical Diagram



4.20 Ladder Diagram



4.21 Electrical Connections

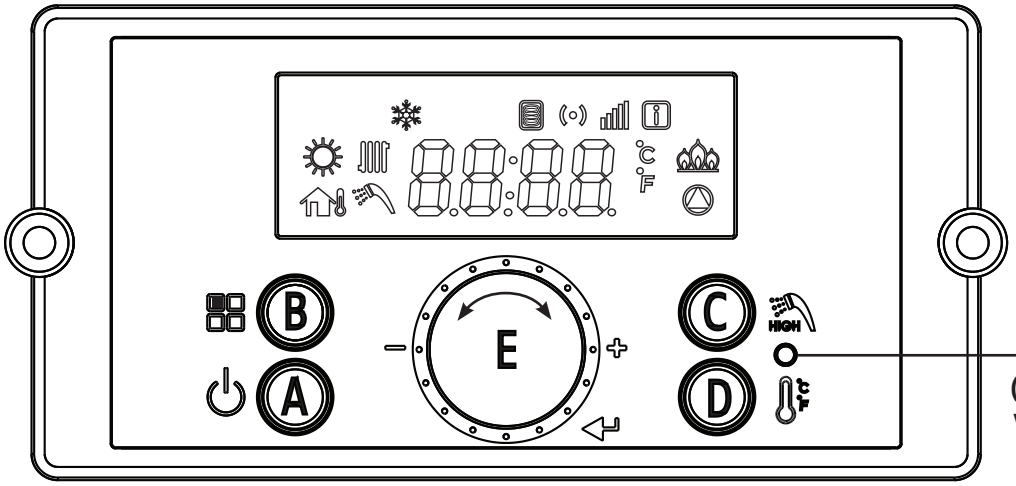
Connector			Description	HT SELV
#, Location, Type	PIN	Label		
CN9 65001WS-12	1	-	GROUND	-
	2	L	Power Supply Line	HT (120VAC)
	3	CP1	Mixing Pump	HT (120V~)
	4	IT	Igniter	HT (120V~)
	5	HEAT/CP2	Central Heating Pump	HT (120V~)
	6	GV	Gas Valve	HT (120V~)
	7	-	-	-
	8	N	Power Supply Neutral	HT (120V~)
	9-12	⌣ N ⌣	AC Power COM Line	HT (120V~)
CN4 LWD1140-06D	1	FAN	Unuse	-
	2		GND	SELV (26VDC)
	3		VDD	SELV (14VDC)
	4		Fan power(start coil)	SELV (26VDC)
	5		Fan power(end coil)	SELV (26VDC)
	6		Fan speed feedback signal	SELV (14VDC)
CN11 LWD1140-16	1	HWL	Unuse	SELV (12V~)
	8			
	2	LWL	Low Water Level Leakage Sensor	SELV (12V~)
	10			
	3	HD	Central Heating Demand	SELV (5V)
	11			
	4	TH	Connect to the Display Control(Thermostat)	SELV (14V)
	12			
	5	APS	Jump (not used)	SELV (14V)
	13			
	6	EL	Jump (not used)	SELV (14V)
	14			
	7	BL	Burner Limit	SELV (14V)
	15			
	8	HL	Condensate Block	SELV (14V)
	16			

4.21 Electrical Connections (continued)

Connector			Description	HT SELV
#, Location, Type	PIN	Label		
CN7 LWD1140-14	1	F.S	Flame Detect Sensor	SELV (5VDC)
	8			
	2	OP.S	Operation water temperature sensor	SELV (5VDC)
	9			
	3	DH.S	DHW temperature sensor	SELV (5VDC)
	10			
	4	I.S	CH Return sensor	SELV (5VDC)
	11			
	5	BG.S	Exhaust temperature sensor	SELV (5VDC)
	12			
	6	ST.S	Storage water temperature sensor	SELV (5VDC)
	13			
	7	SP.S	Over heat temperature sensor	SELV (5VDC)
	14			
CN14 SMW250-09D	1	IWM	GND	SELV (14VDC)
	2		DHM Stepper motor position	SELV (14VDC)
	3		VDD	SELV (14VDC)
	4		DHM Stepper motor coil X phase	SELV (14VDC)
	5		DHM Stepper motor coil Y phase	SELV (14VDC)
	6		VDD	SELV (14VDC)
	7		DHM Stepper motor coil /X phase	SELV (14VDC)
	8		DHM Stepper motor coil /Y phase	SELV (14VDC)
	9		Unuse	-
CN3 SMW250-06D	1	APS SEN-SOR	VCC	SELV (5V)
	2		GND	SELV (5V)
	3		Voltage input	SELV (5V)
	4	FLUX1	VCC	SELV (5VDC)
	5		Water Flow Sensor	SELV (5VDC)
	6		GND	SELV (5VDC)

SECTION 5 Control Display and Operation

5.1 Control Dial and Buttons

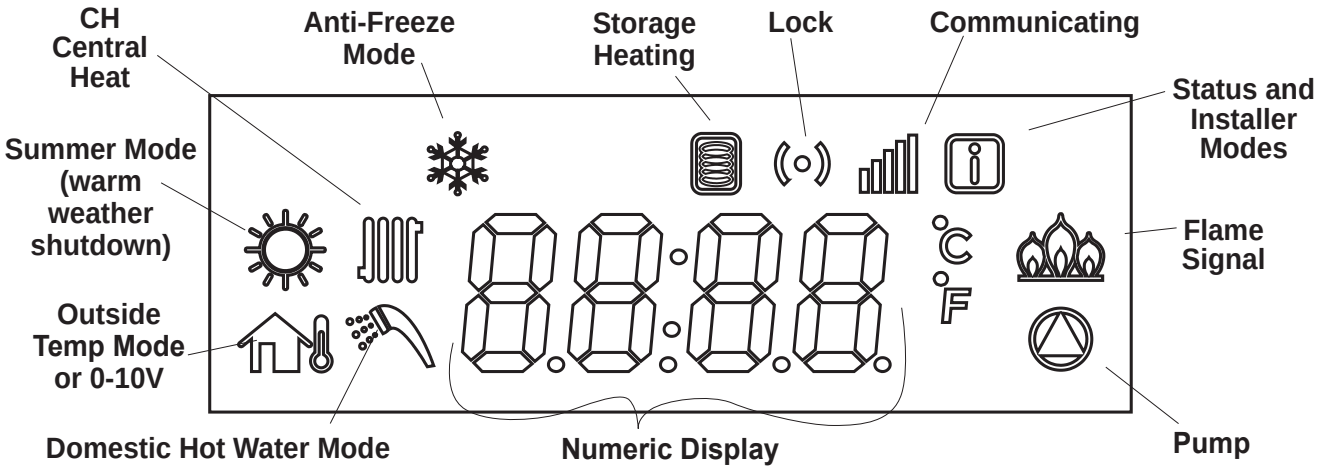


The Control Display has a Control Dial (E), 4 buttons (A, B, C, D), and a Liquid Crystal Display (with 72 back-lit segments). This section of this manual gives instruction on how to navigate into the many functions of the FT and to change temperature set points, set system variables and controller parameters.

Buttons			Function	Method	Function	Method
A		Display Power	Turns Control Display ON/OFF	Press/Tap		
B		Modes	Status Display Mode (With display power on)	Press/Hold (5 Seconds)	Return to Menu (from Status Display Mode)	Press/Tap
			Installer Mode (WIth display power off)	Press/Hold (5 Seconds)	Return to off display off mode (from installer mode)	Press/Tap
C		Hot Water	DHW Set-Point LOW Range 95 - 120°F (35 - 49°C)	Press/Tap (To return home, tap Scroll/Select)	DHW set-point HIGH Range 121-140°F (49.5-60°C) (from DHW set-point LOW RANGE)	Press/Hold (5 Seconds), (To return home, tap Scroll/Select)
D		Central Heat	CH set-point mode (boiler only)	Press/Tap (To return home, tap Scroll/Select)	Toggle (°C/°F) (from CH setpoint mode)	Press/Hold (5 Seconds)
E		Scroll / Select	Turn to scroll (clockwise or counterclockwise), Tap to select	Press/Tap		

- Temperature Specifications
  Operating ambient Temperature Range : -10 to 60°C. (14ºF to 140ºF)
  Operating Relative Humidity up to: 90% at 40°C. (90% at 104ºF)
  Shipping & Storage Temperature Range of : -20 to 80°C. (-4ºF to 176ºF)

5.2 LCD Overview



CH mode	Central Heat mode icon can be adjusted
Anti-freeze mode	Anti-freeze mode icon
Storage Heating mode	Stored Water Being Heated, can be adjusted
Lock mode	Buttons-locked mode icon
Communication	Communication icon
Summer mode	Only DHW Mode, can be adjusted (warm weather shutdown)
Status and Installer mode	The Status Mode or the Installer Mode is Active (all parameters)
Flame signal	Flame Signal icon
Pump icon	Water pump operation (CH or DHW) icon
Numeric Display	Number and character display, to display all parameters
DHW mode	Combination boiler Set Point, can be adjusted
Outside temp or 0-10 V mode	Operating by outside temperature or 0-10V

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

* NOTE: The display will not allow changes when the lock mode is activated.
To exit the Lock mode, press the button.

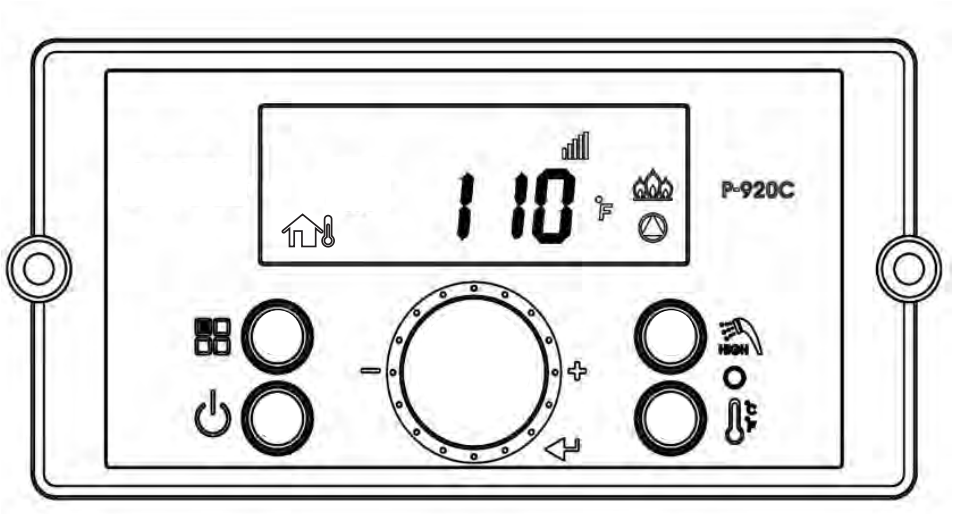
⚠ WARNING

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.

5.3 Operating Mode

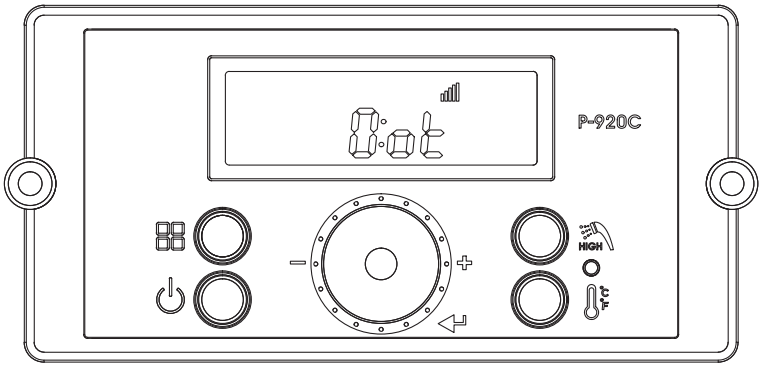
■ Operating Mode

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	Example
Current Operating Temperature	110°F
Temperature sign Celsius or Fahrenheit letter	°C or °F
Display and Controller are communicating	
If flame detected	
If pump is operating	
Outdoor sensor or 0-10V	

5.4 Status Display Mode



Digital Display		Status Display Parameter		Description		
O:ot		Outdoor temperature		Current Outdoor temperature		
A: Li or A: GA		Flow unit		Current flow value(Li: L/m, GA: GPM)		
b: It		CH Return Water Temperature		Current Return Water Sensor Temperature		
C: Fr		Fan rpm		Current fan rpm value		
d: Lc		Lock mode		Lock mode ON/OFF		
E: oP		OP temperature		Current OP temperature		
F: dH		DHW temperature		Current DHW temperature		
H: Eh		Exhaust temperature		Current Exhaust temperature		
I : St		Storage Temperature		Current Storage Temperature		
J: oH		Overheat temperature		Current Overheat temperature		
L: rt	1: PH	Burner Operation Time	Supply power time	Supply power time x 100 hour		
	2: rh		Burner operation time	Burner operation time x 1 hour		
	3: rH		Burner operation time	Burner operation time x 1,000 hour		
	4: It		Ignition cycles	Ignition cycles x 10 times		
	5: IH		Ignition cycles	Ignition cycles x 10,000 times		
P: Ou		Displays output condition for internal primary pump and three way valve. - Off - On		1st Icon	2nd Icon	3rd Icon
				Internal Pump	CH Pump	Not Used
						
						

To change any of the above listed Status Parameters,

Press and Hold Button B to get into the Status Display Mode.

Rotate Dial E until you find the Parameter that you wish to change. Tap Dial E to enter that Parameter.

All other modes except d:Lc (Lock mode) are to display current status, therefore you need to check the current setting and press button to exit.

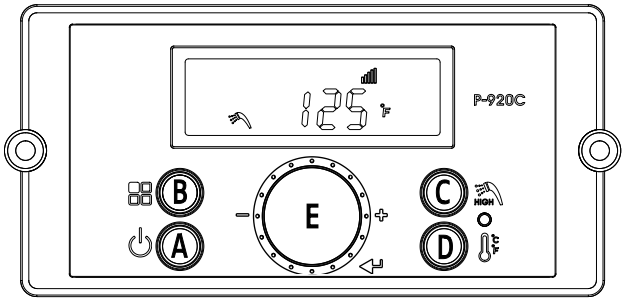
5.5 DHW Set Point Change Mode

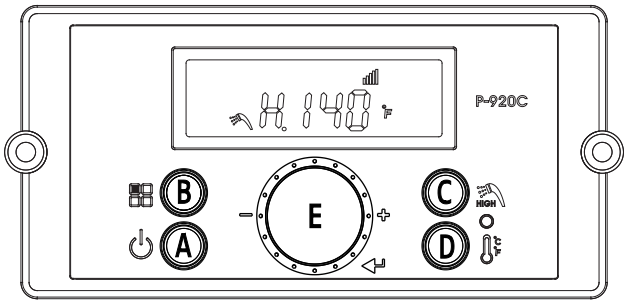
■ DHW Set Point Change Modes

The display shows the following information when changing water heating temperature set points.

Changing between Celsius and Fahrenheit

When the button D is pressed (for more than 5 seconds), temperature unit will toggle between °C and °F.





Indicate	Example
Current DHW set-point temperature	125°F
Temperature sign Celsius or Fahrenheit letter	°C or °F
If display is communicating with the main controller normally, the communication icon will be indicated.	
When DHW set-point range is high : from 121°F (49.5°C) to 140°F (60.0°C)	H . 140°F
When changing DHW setpoint, the DHW icon will flash	

* Default DHW set-point is 125°F (51°C)

• DHW 95-120°F (35 - 49°C) LOW range (Default)

-To change LOW range, press the C Button. The DHW icon and current DHW LOW will flash (a flashing value means it can be changed).

-Turn dial E clockwise to increase and counterclockwise to decrease until desired temperature is reached.

-Press dial E to save setpoint changes.

• DHW 121 - 140°F (49.5 - 60°C) HIGH range

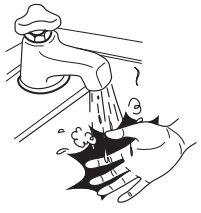
-To change HIGH range, press and **HOLD** the C button for more than 5 seconds. The DHW icon and current DHW HIGH will flash (a flashing value means it can be changed).

-Turn dial E clockwise to increase and counterclockwise to decrease until desired temperature is reached.

-Press dial E to save setpoint changes and to Exit.

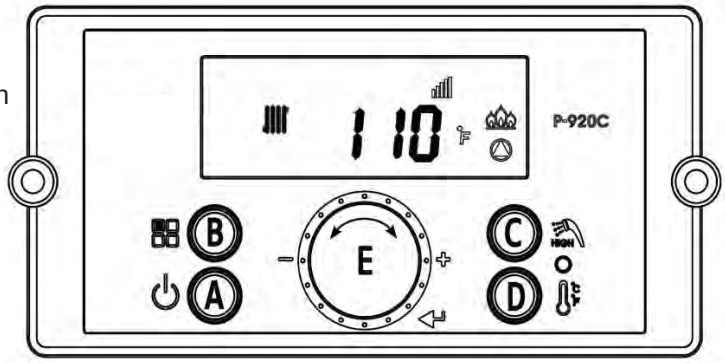
⚠ DANGER

Scalding may occur within 5 seconds at a setting of 140°F (60°C). Water temperatures over 125°F can cause severe burns, or death from scalding. Children, disabled, and elderly are at highest risk of being scalded. Read all instructions before setting temperature at appliance. Feel water before bathing or showering.



5.6 CH Set Point Change Mode

Changing between Celsius and Fahrenheit
When the button D is pressed (for more than 5 seconds), temperature unit will toggle between °C and °F.

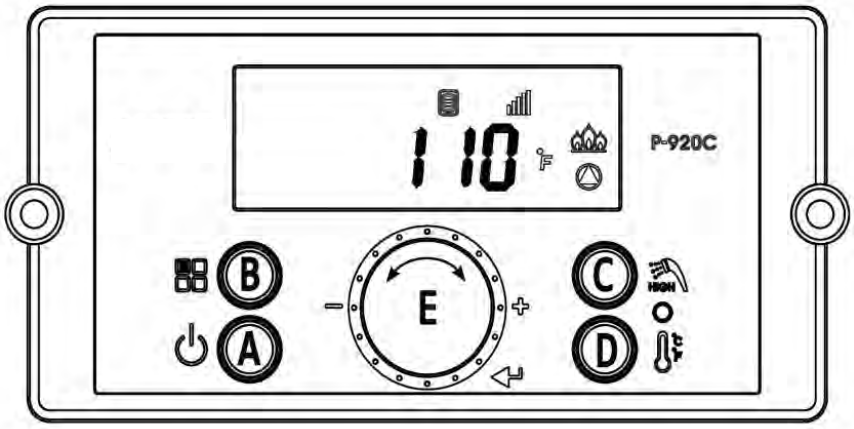


Indicate	Example
Current Operating Temperature	110°F
Temperature sign Celsius or Fahrenheit letter	°C or °F
Display and Controller are communicating	
If flame detected	
If pump is operating	
When changing CH Setpoint, the CH Icon will flash	

Default CH set-point is 120°F (49°C)
CH set-point range is 86 - 180°F (30.0 ~ 82.0°C)

To change CH Setpoint, press the button D button. The CH Icon and current CH Setpoint will flash.
Turn the E dial clockwise to increase, and counterclockwise to decrease CH setpoint, until desired temperature is reached.
Press E dial to save changes and to Exit.

5.7 Storage Mode



Indicate	Example
Current Operating Temperature	110°F
Temperature sign Celsius or Fahrenheit letter	°C or °F
Display and Controller are communicating	
If flame detected	
Storage mode indication	
If Pump is operating	

To change Storage Mode Temp, First turn OFF the power to the Control Display.

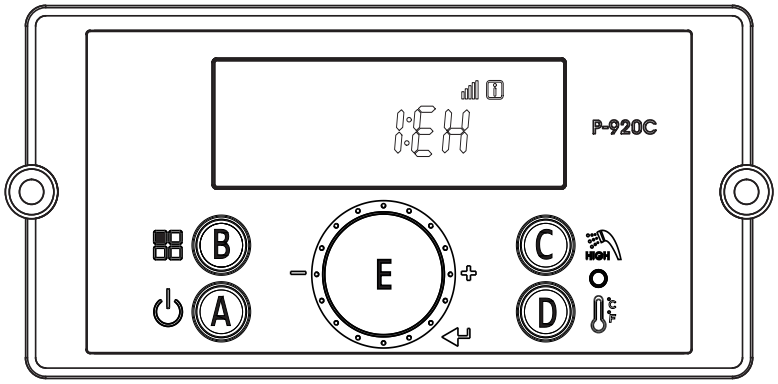
Then Press and Hold Button B to get into the Installer Mode.

Rotate Dial E until you find **24:SF** Tap Dial E to enter Storage Mode. Storage Mode indicates that the boiler is heating the water held in the internal storage tank. 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.

5.8 Installer Mode



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

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

Then, with the power to the Display Control 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 and then press (tap) Dial E to save and to Exit.

Finish by pressing button B

Index	Parameter	Description
1: EH	History entry	History fault code (E0~E9)
2: cE	Clear Error History	Clearing of error History buffer
3: In	System initialize	System initialize to default
4: Fu	Flow unit	gallon / liter
5: St	Heat storage function	Heat storage function On/Off
6: OH	Maximum Outdoor Temperature	Range: (Minimum Outdoor Temperature + 9°F) to 110°F Default 68°F (20°C)
7: OL	Minimum Outdoor Temperature	Range: -4°F to (Maximum Outdoor Temperature - 9°F)
8: FH	Max fan	Adjusts Maximum Fan Speed Range: -30 - +30
9: FL	Min fan	Adjusts Minimum Fan Speed Range: -30 -+30
10: dr	Delete running time	Delete running time
11: dI	Delete igniting times	Delete igniting times
12: bt	Outside Unit Function Delay Time (boost time)	When heating in the outside unit function for the first time, there will be a delay. (0~120 min, Default 0)
13: Ft	Delay time for heating burner operation	Burner does not operate during the delay time when the burner is turned off due to the temperature during heating operation. (0~20 min, Default 1 min)
14: bo	Setting temperature of burner ON.	Heating temperature setting during heating operation – Operate in burner ON temperature setting Range: -12.7°C(9°F)~-2.7°C(27°F), Default 2.7°C(27°F)
15: OF	Warm Weather Shutdown	This warm weather temperature setting will shut down CH Mode 10°C(50°F)~43°C(110°F), Default 38°C (100°F)
16:cH	Setting for Heating Maximum Temperature	Range: 9°F less than Minimum Temperature to 180°F, Default 180F 12.7°C less than Minimum Temperature to 82°C, Default 82°C
17:cL	Setting for Heating Minimum Temperature	Range: 86°F to (9 degrees °F less than Maximum Temperature, Default 86°F 30°C to (12.7degrees °C less than Maximum Temperature, Default 30°C
18:dH	Setting for Hot Water Maximum Temperature	49°C(120°F)~60°C(140°F), Default 60°C(140°F)
19:cb	Heating Combustion Rate	50%~100%, Default 100%
20:db	Hot Water Combustion Rate	50%~100%, Default 100%
21:PP	Pump Post-Purge Time	(Heating Pump) 1min ~ 60min, Default 40min
22:Po	Pump on Time	(Heating Pump Repeat ON Time) 1 min ~60 min, Default 5 min
23:PF	Pump off Time	(Heating Pump Repeat Off Time) 0min ~60 min, Default 10 min
24:SF	Heat storage off Temperature	60°C(140°F)~75°C(167°F),Default(70°C)158°F
25:So	Heat storage on Temperature.	(off Temperature-Setting Temperature) -12.7°C(9°F)~2.2°C(36°F), Default (-2.7°C) 27°F
26:dt	Delay time when switching from DHW mode to CH mode	Range: 0 – 2 minutes,Default 2min
27:PE	Internal CH Pump Post-Purge Time, T/T Satisfied	Allows the user to set the appliance pump post purge time once the appliance CH setpoint and thermostat are satisfied. Range: 1-5 minutes,Default 1min
28: HA	High Altitude setting	(Normal)0<1<2<4 (High)
29: AP	Internal CH Pump and 3-way valve Pump Test Mode	This function sets the time to run both the Internal CH and 3-way valve pumps to purge air from the system. Range: 1 – 30 minutes ,Default 5min
	Internal CH Pump and 3-way valve Pump Test Mode	Turn this function on to activate Internal CH and 3-way valve pump testing. Only works in installation mode. Turns off when in normal mode. Default OFF
30: dP	DHW Timeout Feature	Range: 0~12 time, '0' OFF, Default: 4 time

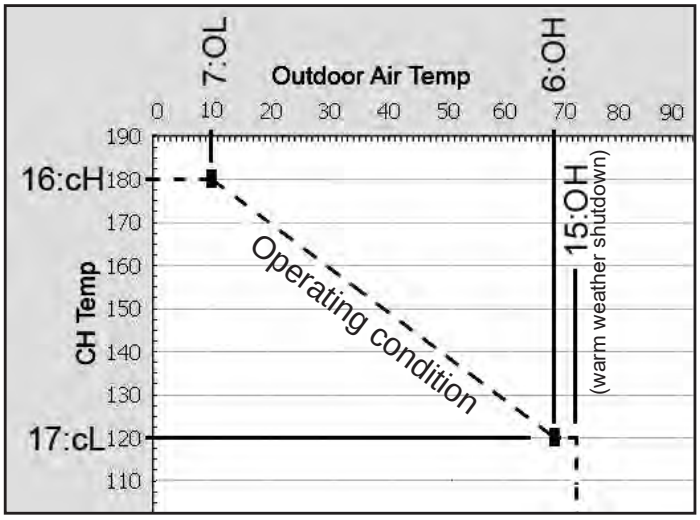
The Full List of Installer Mode Parameters

5.9 Outdoor Reset Adjustment

Outdoor Reset varies the control setpoint based on the outdoor temperature. The reset function works as shown in Figure 'CH Outdoor Reset'. When the outdoor air temperature reaches 6:OH "high outdoor temperature setpoint", the control point setting is adjusted to 17:cL "low boiler temperature setpoint". When the outdoor air temperature reaches 7:OL "low outdoor temperature setpoint" the control setpoint is adjusted to 16:cH "high boiler temperature".

Default outdoor reset setpoint 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.



CH Outdoor Reset

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 setpoint 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.

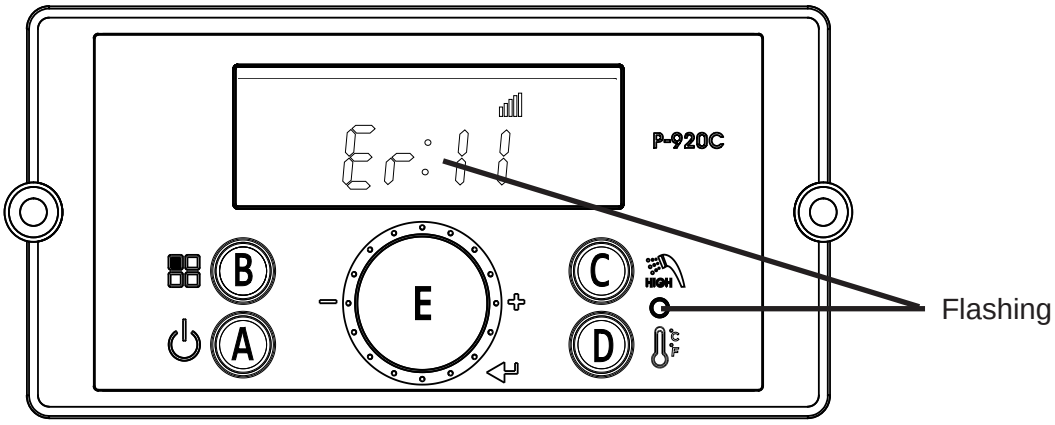
The control interprets the 0-10 volt signal as follows; when the signal is between 0 and 1.5 volts, the appliance will be in standby mode, not firing.
When the signal rises above 1.5 volts, the appliance will ignite. As the signal continues to rise towards its maximum of 10 volts, the appliance will increase in set point temperature. Adjust 16:cH and 17: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 setpoint simultaneously.

5.11 Error Mode



Indicate	Example
Error ‘ Er : ’ will flash	Er:11
Error Code	Er:11
Display and Controller are communicating	

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	Flame has Extinguished 8 (Eight) Times	Press the Power button to clear the Error Code. If Error happens again: 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 vent terminations. Ensure there are no blockages. 5. Assure that the flame is stable when lit. 6. If the problem persists, replace the main control.	Hard Lock
11	Ignition has Failed 10 (Ten) Times	Press the Power button to clear the Error Code. If Error happens again: 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. 7. Assure that the flame is stable when lit. 8. If the problem persists, replace the main control.	Hard Lock
16	Operating Temperature Sensor detects Water Temperature Greater than 203°F (95°C)	Press the Power button to clear the Error Code. If Error happens again: 1. Check if dip switch 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. If the problem persists, replace the main control	Hard Lock
20	Condensate – Closed is Normal, Open is Fault (Condensate Drain Trap)	Press the Power button to clear the Error Code. 1. Check Condensate and main controller connections. Ensure all are secure. 2. Check Condensate sensor resistance. If resistance is 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 problem persists, replace the main control.	Hard Lock
28	Overheat Sensor Open or Short	This Error Code will go away when CH temperature decreases. If Error happens again: 1. Check overheat temperature sensor. Ensure connections are secure. 2. Check overheat sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.	Soft Lock
30	DHW Storage Temperature Sensor Open or Short	This error Code will go away when outlet stroage temperature decreases. If Error happens again: 1. Check stroage temperature sensor. Ensure connections are secure. 2. Check sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.	Soft Lock
32	DHW Sensor Open or Short	This Error Code will go away when outlet DHW temperature decreases. If Error happens again: 1. Check DHW outlet temperature sensor. Ensure connections are secure. 2. Check sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.	Soft Lock
33	CH Temperature Sensor Open or Short	This Error Code will go away when CH temperature decreases. If Error happens again: 1. Check CH temperature sensor. Ensure connections are secure. 2. Check CH sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.	Soft Lock

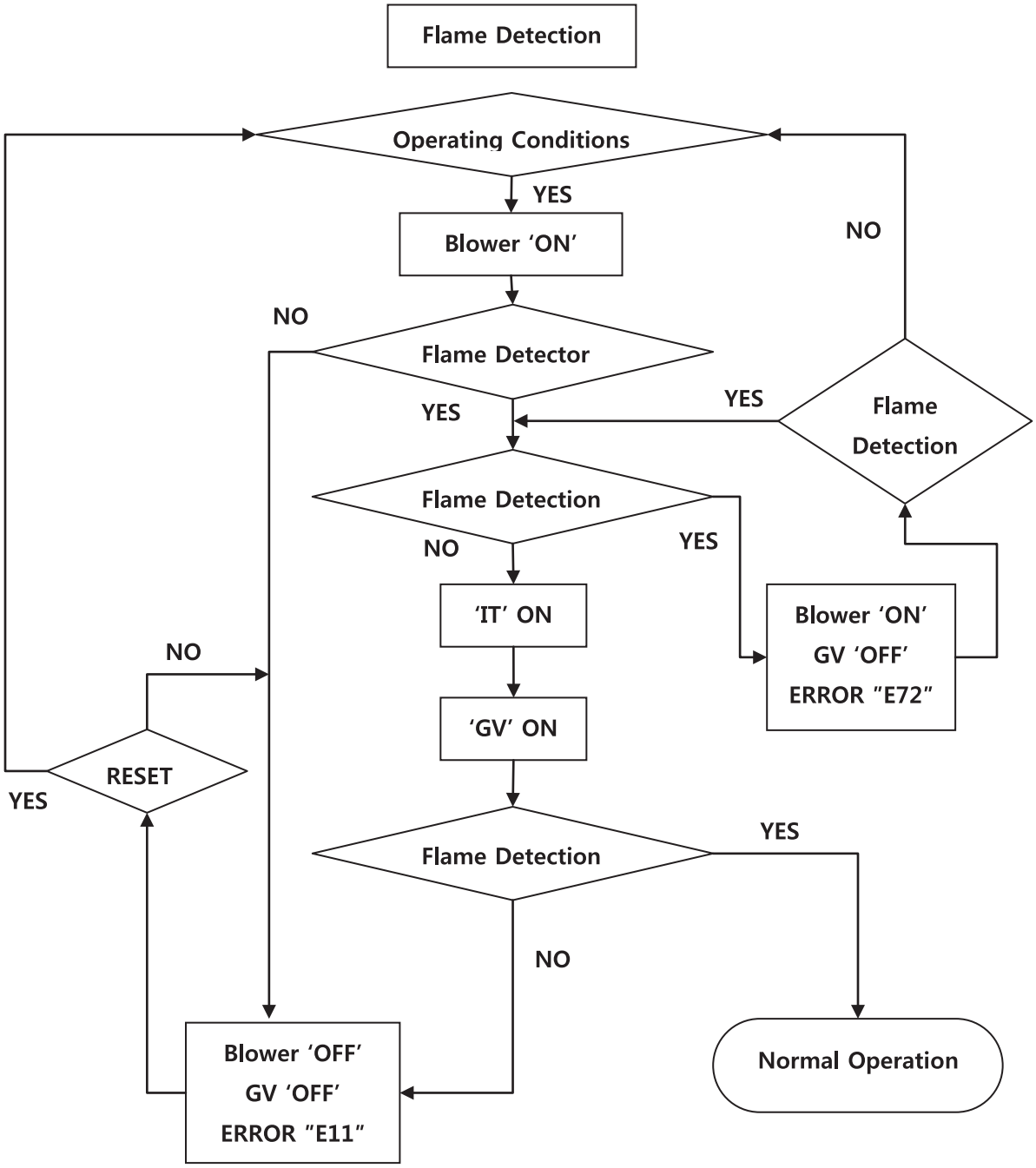
Error Code	Error Code Description	Possible Remedies	Recover methods
35	Venting (Exhaust) Sensor Open or Short	This Error Code will go away when exhaust temperature decreases. If Error happens again: 1. Check Venting (exhaust) temperature sensor. Ensure connections are secure. 2. Check sensor resistance. If resistance is zero, replace the sensor. 3. Check vent pipes for blockage. 4. If the problem persists, replace the main control	Soft Lock
36	Abnormal Supply Voltage	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, replace the main control	Soft Lock
37	Abnormal Supply Frequency	Supply frequency is too high to operate. This Error Code will go away when supply frequency returns to normal operating range. If Error happens again: 1. Ensure appliance is properly wired to a power source meeting the requirements on the rating plate. 2. If problem persists, replace the main control.	Soft Lock
38	Error Appears When Control Stores Data, but Data is not Saved	Press the Power button to clear the Error Code. Replace the main control.	Hard Lock
40	Gas Leakage is Detected for Greater than 5 seconds, or three times within 10 minutes	IMPORTANT: If you smell gas, STOP! Follow the instructions on page 2, this manual, and call a qualified service technician or the fuel gas utility. Press the Power button to clear the Error Code. If Error happens again: 1. Check the 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, replace the main control.	Hard Lock
41	Fan Speed too High with Flame On	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. If the problem persists, replace the main control.	Hard Lock
42	LWCO Jumper Wire	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, replace the main control.	Soft Lock
43	Burner Overheat Switch Open	Press the Power button to clear the Error Code. If Error happens again: 1. Check burner overheat switch connections. Ensure connections are secure. 2. Check switch resistance. If resistance is zero, replace the switch. 3. If the problem persists, replace the main control.	Hard Lock
44	Air Pressure Sensor (APS) Fault	Press the power button to reset If error happens again: 1. Check the vent pipe for blockages. 2. Check the vent pipe for blockages. 3. If error do not clear, replace the APS 4. If the problem persists, replace the main control.	Hard Lock
45	Air Pressure Sensor (APS) Open	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, replace the main control.	Soft Lock
61	Fan Speed Feedback Signal Abnormal	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check the connections to the fan. Ensure all are secure. 2. If the fan does not rotate during the ignition sequence, check for AC8V~26.5V power at the fan connection. If AC8V~26.5V power is present at the control, replace the fan. If the blower does not have AC8V~26.5V power, check power at the control. If AC8V~26.5V power is not present at the control, replace the control. 3. If the problem persists, replace the main control.	Soft Lock

SECTION 6. Error Codes (continued)

Error Code	Error Code Description	Possible Remedies	Recover methods
66	Mixing Valve Initial Value Error (Mixing Valve Cannot Return to Initial Position)	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. Check wiring connections to mixing valve. Ensure all are secure. 3. Replace mixing valve. 4. If the problem persists, replace the main control.	Soft Lock
68	Mixing Valve Operation Error (Mixing Valve Stuck in Initial Position)	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. Check wiring connections to mixing valve. Ensure all are secure. 3. Replace mixing valve. 4. If the problem persists, replace the main control.	Soft Lock
70	Register, Ram, Rom, I/O Port, AD Abnormal, Important EPROM Data or Safe Data Abnormal	This Error Code will go away when the condition is remedied. If Error happens again: 1. Turn power OFF and ON at the main power switch internal to the appliance. 2. If the problem persists, replace the main control.	Soft Lock
72	Flame Signal Detected before Ignition	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. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 3. If the problem persists, replace the main control.	Soft Lock
76	Poor Communication	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check connections from main control to display panel. 2. If the problem persists, replace the display and/or the main control.	Soft Lock
80	Low Water Level Sensor (Low Water Level Detected Four (4) Consecutive times)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Ensure all valves are open to the 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, replace the main control.	Soft Lock
81	Low Water Level Circuit	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, replace the main control.	Soft Lock
85	Freeze Protection (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. 2. Check wiring connections to low water level sensor. Ensure all are secure. 3. Check low water level sensor resistance. If resistance is zero, replace the sensor. 4. If the problem persists, replace the main control.	Soft Lock
94	Exhaust Sensor detects Vent Temperature is Greater than 190°F (88°C)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check if dip switch 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, replace the control. 6. If the problem persists, replace the heat exchanger.	Soft Lock

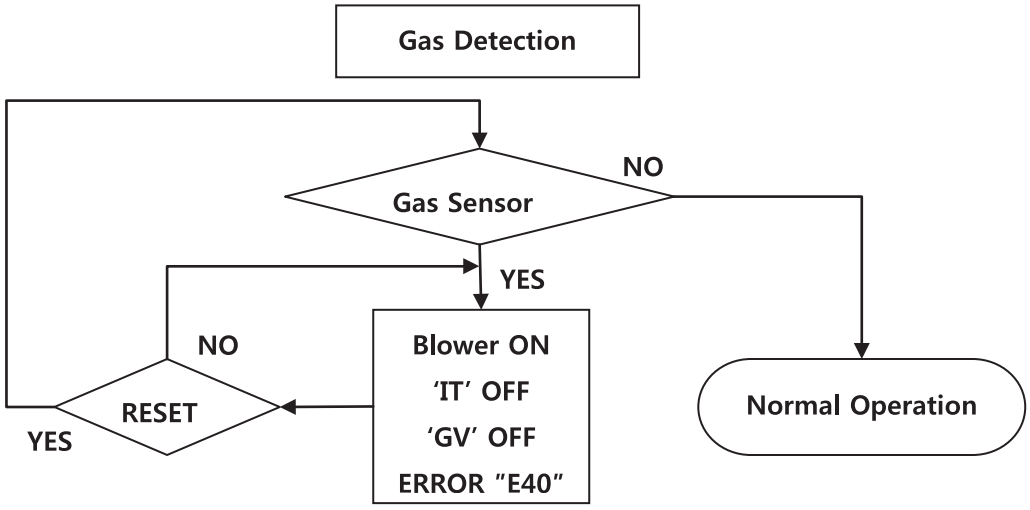
6.2 Fault Tree Analysis

6.2.1 Flame detection

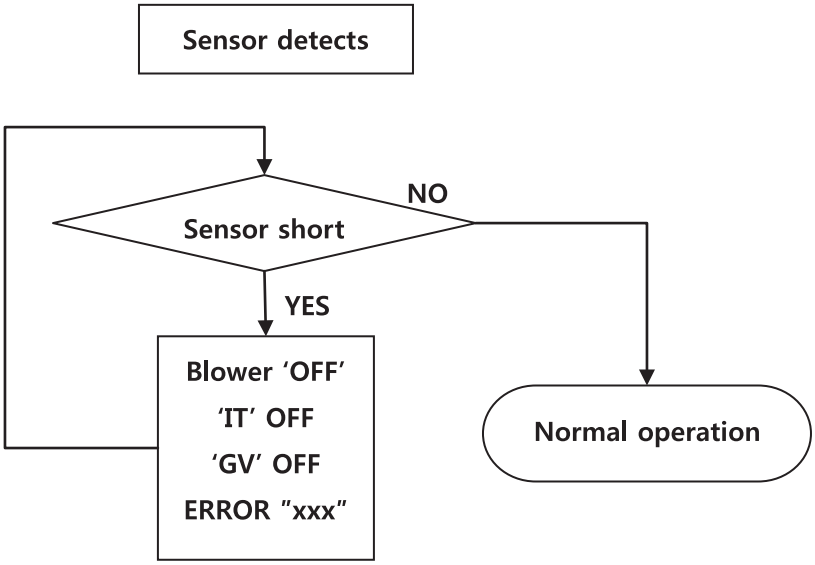


6.2 Fault Tree Analysis (continued)

6.2.2 Gas Detection



6.2.3 'Storage', 'DHW', 'OP', 'CH overheat', 'Exhaust heat' Sensor detects



Error code	contents
E30	DHW Storage Temperature Sensor open or short
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
Burner does not ignite when the hot water is opened.	Make sure that the ON/OFF button on the Control Panel has been turned ON.
	If the monitor on the Control Panel is blank, make sure the power cord is plugged and 4A fuses on the main controller in the units are good.
	Make sure that there is water supplied to the unit. The unit activates once the inlet water flow is over 0 gpm.
	Make sure the cold and hot water lines are not plumbed in reverse side.
	Make sure that the cold water and gas supply lines are opened.
	Make sure that the water lines are not frozen.
Water is not hot enough.	Check that the setting temperature on the unit is not too low
	Make sure that the filter in the cold water supply line is not clogged with debris.
	Make sure that the gas supply type is correct.
	Check the supply and manifold gas pressures are in accordance with specifications.
	Make sure that the water flow sensor with three wires has been properly connected on the top of heat exchanger.
Water is too hot.	Make sure that the setting temperature on the unit is not too hot.
	Make sure that the filter in the cold water supply line is not clogged with debris.
	Make sure that the gas supply type is correct.
Hot water temperature fluctuates at the opened tap.	Make sure that the filter in the cold water supply line is clean.
	Make sure that the gas supply type is correct.
	Check the supply gas pressure is sufficient.
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.
Heater doesn't fire when DHW flow is initiated	Domestic water flow may be too low. Min allowable is 0.75 gpm. Check in Manual Mode OTO AGA
CH Temp drops lower than expected before unit re-fires	Change Parameter 14:bo to 10degrees 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 '5.10 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.

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 ignitron 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
			Check air intake pipe and proper propane orifice
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.

SECTION 8 Maintenance

8.1 Annual Startup & General Maintenance

■ Regular Maintenance

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

■ Maintenance procedures [Daily]

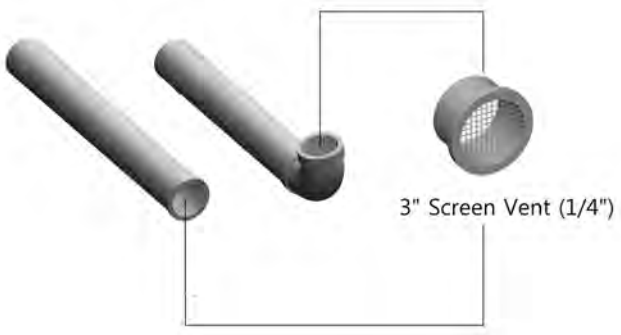
- Check that the boiler casing is closed.
Check if there is any problem with the Combination boiler casing and the two upper and lower screws are tightened well. Combination boiler casing must be closed while it is running.

⚠ WARNING

To prevent potential severe personal injury, death or substantial property damage, remove all contaminated materials.
If contaminants are found:
Remove products immediately from the area.
In order to check the status of Combination boiler, call a qualified service technician to inspect the Combination boiler for possible damage from acid corrosion.

⚠ WARNING

DO NOT store combustible materials, gasoline or any other flammable vapors or liquids near the Water Heater. 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 a Combination boiler. (Power line through the strain relief in the bottom of the combination 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 to be sure it is unobstructed. Inspect entire length of air piping for ensuring that piping is intact and all joints are properly sealed. Call your qualified service technician if you notice any problems.

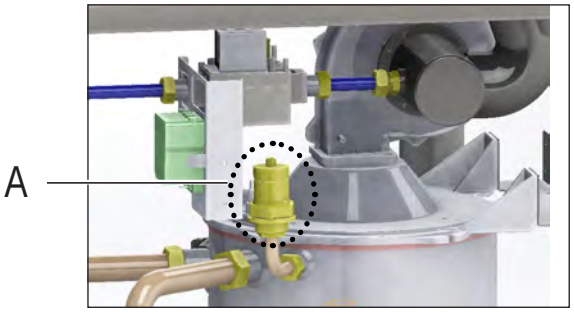
- Check the relief valve.
Inspect the Combination boiler relief valve and the relief valve discharge pipe for any signs of weeping or leakage. If the relief valve often weeps, immediately contact your qualified service technician for inspecting the Combination boiler and system.

- Check the condensate outlet.
While the Combination 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. Call your qualified service technician for inspecting the Combination 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 specifications, 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, replace cap “A” by twisting all the way on. Loosen cap “A” one turn to allow vent to operate. If vent does not operate correctly, replace the vent.



FTCF 140

FTCF 199

- 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, 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. 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 Combination boiler immediately. Call your qualified service technician to inspect the combination boiler and system.

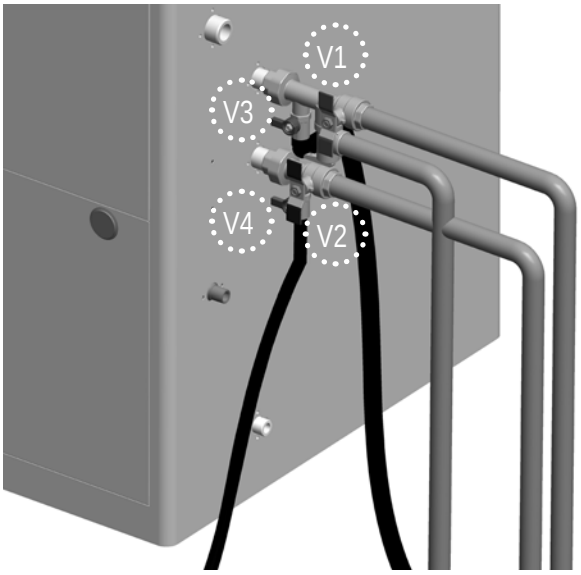
- Check the burner state
You can clean the exterior of burner. However, if you need to clean the inside of the burner stage, you should call a qualified service technician.

■ Maintenance procedures [Every 6 Months]

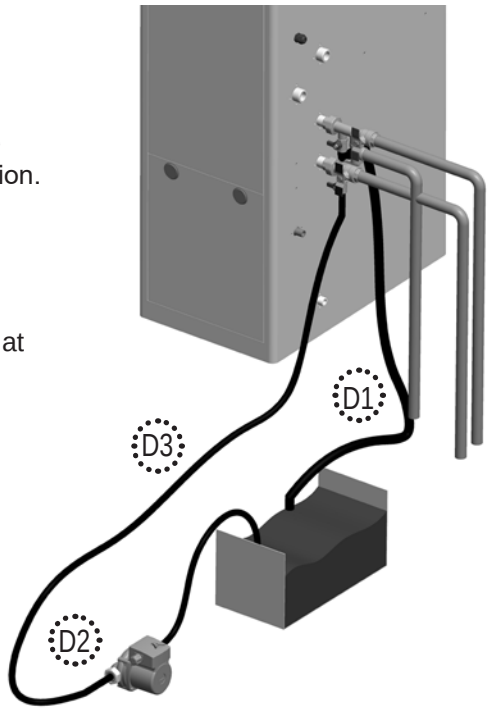
- Check the boiler piping (gas and water)
Visually inspect for leaks around internal water piping. Also inspect external water piping, circulators, relief valve and fittings. Immediately call a qualified service technician to repair any leaks. Leaks must be fixed by a qualified service technician immediately.
Failure to comply with this instruction could result in severe personal injury, death or substantial property damage.

8.2 Flushing or Draining

Flushing the Heat Exchanger is a complicated procedure that should only be done by an authorized technician or licensed professional. Keep in mind that improper maintenance can void your warranty.



1. Disconnect electric power to the combination boiler.
2. Close the shutoff valves on both hot water outlet and cold water inlet lines. (V1 & V2)
3. Connect one hose “D1” to the valve “V3” and place the free end in the bucket. Connect one of the hoses “D3” to the circulation pump outlet and the cold water inlet line at the valve “V4”. Connect other hose “D2” to the circulation pump inlet and place the free end in the bucket.



4. Pour the cleaning solution into the bucket. Place the drain hose (D1) and the hose (D2) to the pump inlet into the cleaning solution.
5. Open service valves (V3 & V4) on the hot water outlet and cold water inlet lines.
6. Turn on the circulation pump (Operate the pump and allow the cleaning solution to circulate through the combination boiler for at least 1 hour at a rate of 4 gallons per minute.)
7. Rinse the cleaning solution from the combination boiler as follows:
   - Remove the free end of the drain hose (D1) from the bucket.
   - Close service valve, (V4), and open shut off valve, (V2). Do not open shut off valve, (V1).
   - Allow water to flow through the combination boiler for 5 minutes.
   - Close shut off valve (V2).
8. Ensure service valves (V3 & V4) are closed and shut off valves (V1 & V2) are open.
9. Disconnect all hoses.
10. Remove the cold water inlet filter from the combination boiler and clean out any residues.
11. Connect electrical power to the combination boiler.

Draining the Combination Boiler.

1. Place a bucket under the appliance to collect the residual water inside the combination boiler.
2. Press Power button on the front control panel to turn OFF the electrical power to the combination boiler.
3. Turn off the gas valve.
4. Close water supply valve on the inlet to the appliance. If there is no valve, turn off main water valve.
5. Open the hot water faucets completely.
6. To refill the combination boiler, follow the steps of “Draining the Combination Boiler ” in reverse.

8.3 Freeze Protection

FT Series 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.

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 50%. A 50% mixture of glycol will result in a BTU output loss of 30% with a 50% increase in head against the system circulator.

• 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 50% by volume solution expands 4.8% in volume for a temperature increase from 32◦F to 180◦F, while water expands 3% over the same temperature rise.

⚠ 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.

⚠ 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%.

⚠ 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.

SECTION 9 Installation Check

9.1 Quick View

- Before Installing
  - Make sure that there is enough space for installing Water and gas line.
    Verify vent/air termination is located as required.
  - All models need for propane Conversion which requires a separate gas conversion manual.

- 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 35)

- Install Vent & Air Piping
  - Slide the air inlet pipe and vent pipe into the Boiler pipe connector.
  - 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.

- 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 properly mounted on the wall?
  - Is there space for a drain which is close to 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?
  - 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 or BH Special 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 drain or laundry tub?

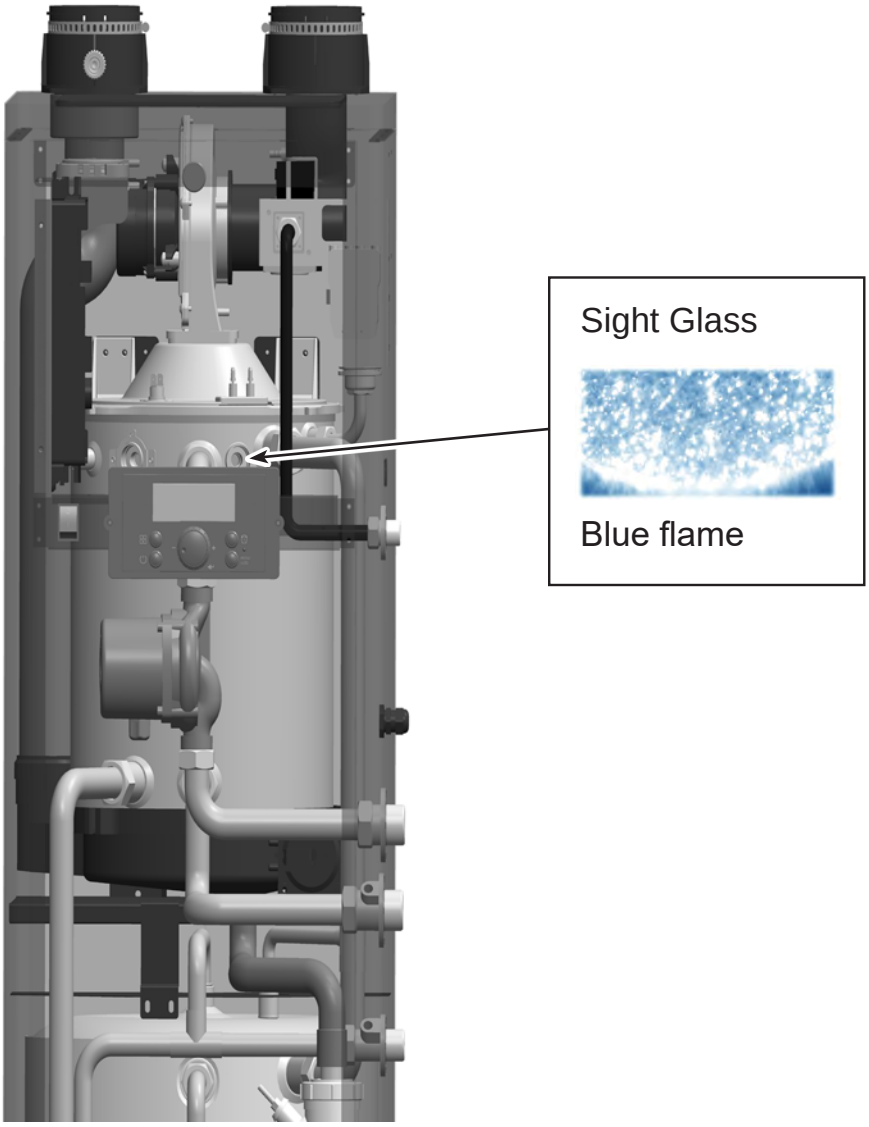
- Final check : Setting the DIP switches
  - Are all DIP switches correctly set on the main board?

9.2 Final Check Lists (continued)

- 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 installed an approved pressure relief valve on the boiler?
  - Is the pressure relief valve of CH Plumbing at least 1″ in diameter?
  - Is the pressure relief valve of DHW Plumbing at least 3/4″ in diameter?
  - Have you installed the pressure relief valve on the hot water outlet pipe near the Boiler?

- Final check : Burner flame
  - 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.



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SECTION 10 Parts List and Illustrations.

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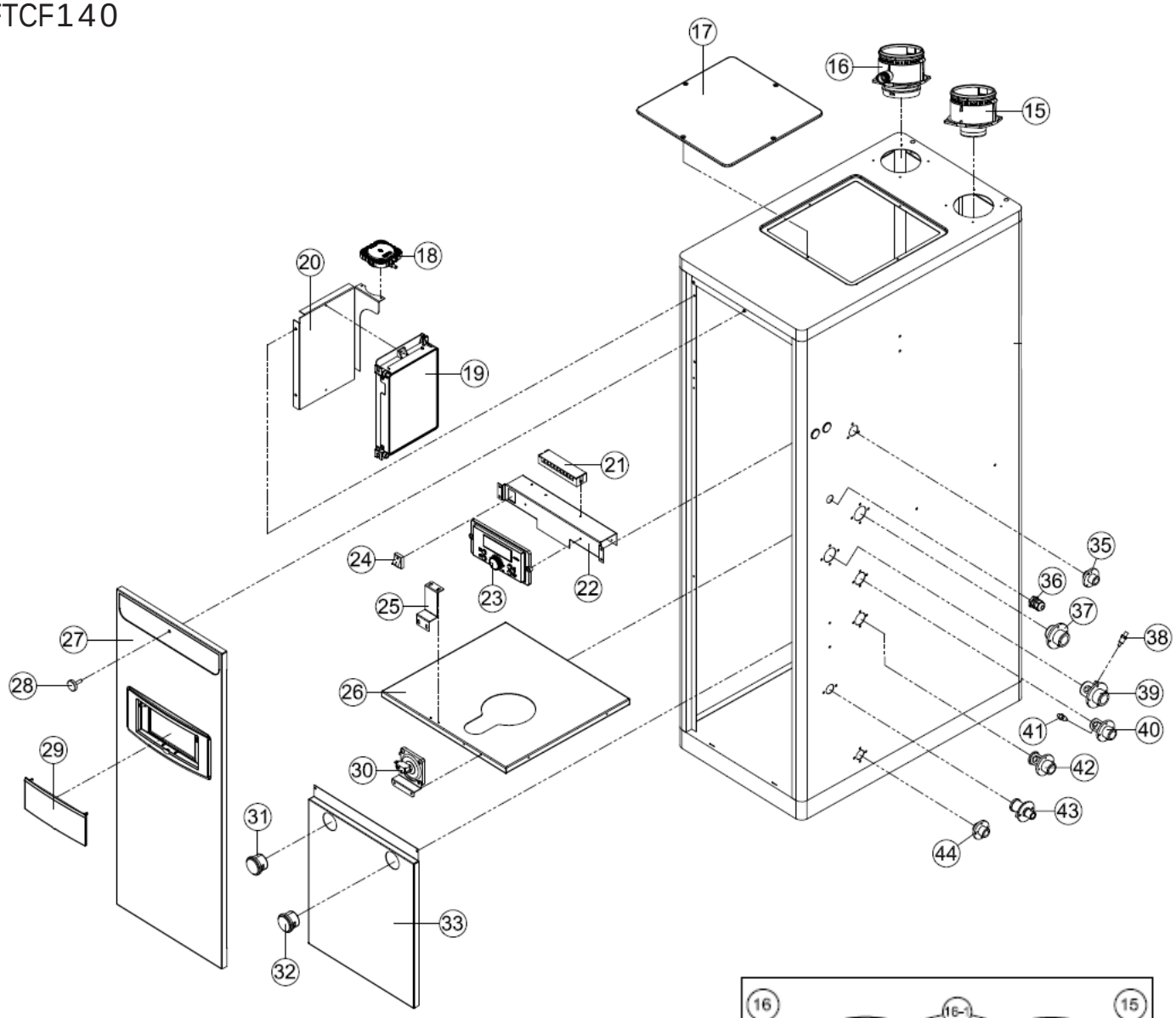
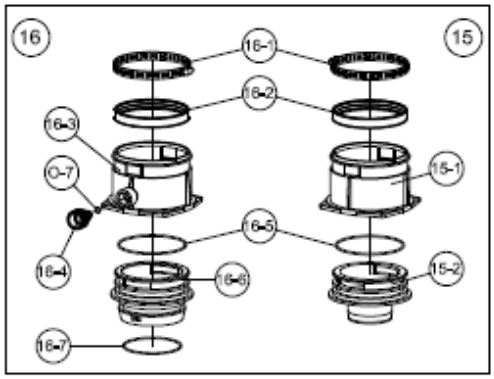
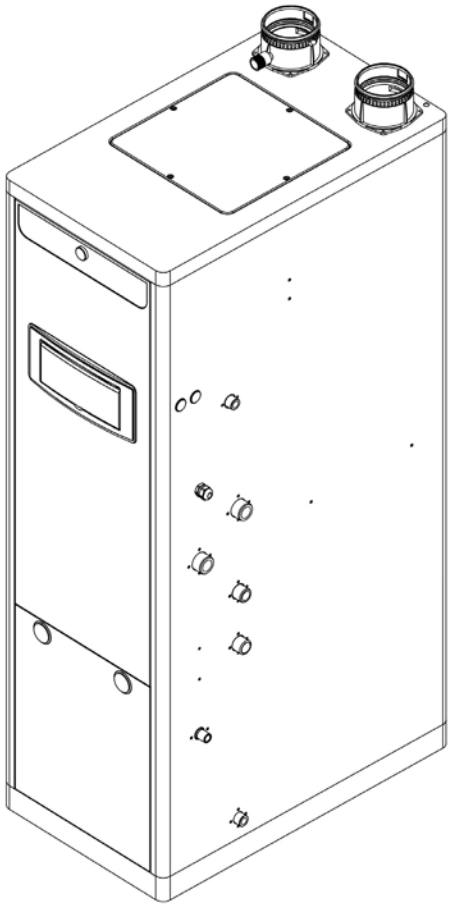




No.	Description	Part Number
O-7	O-Ring P7	FT1601
15	Air inlet duct Ass'y	FT1010
15-1	Air inlet duct	FT1605
15-2	Air inlet adaptor(Inside)	FT1612
16	Exhaust vent duct Ass'y	FT1002
16-1	Stainless band(Ø100)	FT1603
16-2	Packing	FT1604
16-3	Exhaust vent duct	FT1611
16-4	Exhaust testing cap	FT1606

No.	Description	Part Number
16-5	O-Ring P85	FT1607
16-6	Exhaust vent adaptor(Inside)	FT1608
16-7	O-Ring P75	FT1609
17	Upper AS Cover	FT1891
18	Air pressure sensor(18)	FT1015
19	PCB Control (GTX-920CP)	FT1616
20	Control bracket	FT1617
21	Terminal block(10P)	FT1021
22	Control sub bracket	F1951
23	Display Control (P-920C)	FT1019
24	Power switch	FT1020
25	DHW Tank Cover BK	FT1622
26	Casing(Bottom)	FT1952
27	Front Cover(Upper)	FT1911
28	Casing Bolt	FT1830
29	Control display cover / window	FT1024
30	Condensate blockage, Air pressure switch	FT1022
31	Pressure gauge 150 Psi	FT1628
32	Pressure gauge 60 Psi	FT1629
33	Front Cover(Down)	FT1630
35	Gas inlet adaptor	FT1893
36	Cable gland	FT1633
37	CH supply connector	FT1634
38	CH Return sensor	FT1635
39	CH return adaptor	FT1636
40	DHW outlet adaptor	FT1637
41	DHW Outlet sensor	FT1638
42	DHW inlet connector	FT1639
43	Stainless connector	FT1892
44	Drain Adaptor	FT1641



Heat Exchanger

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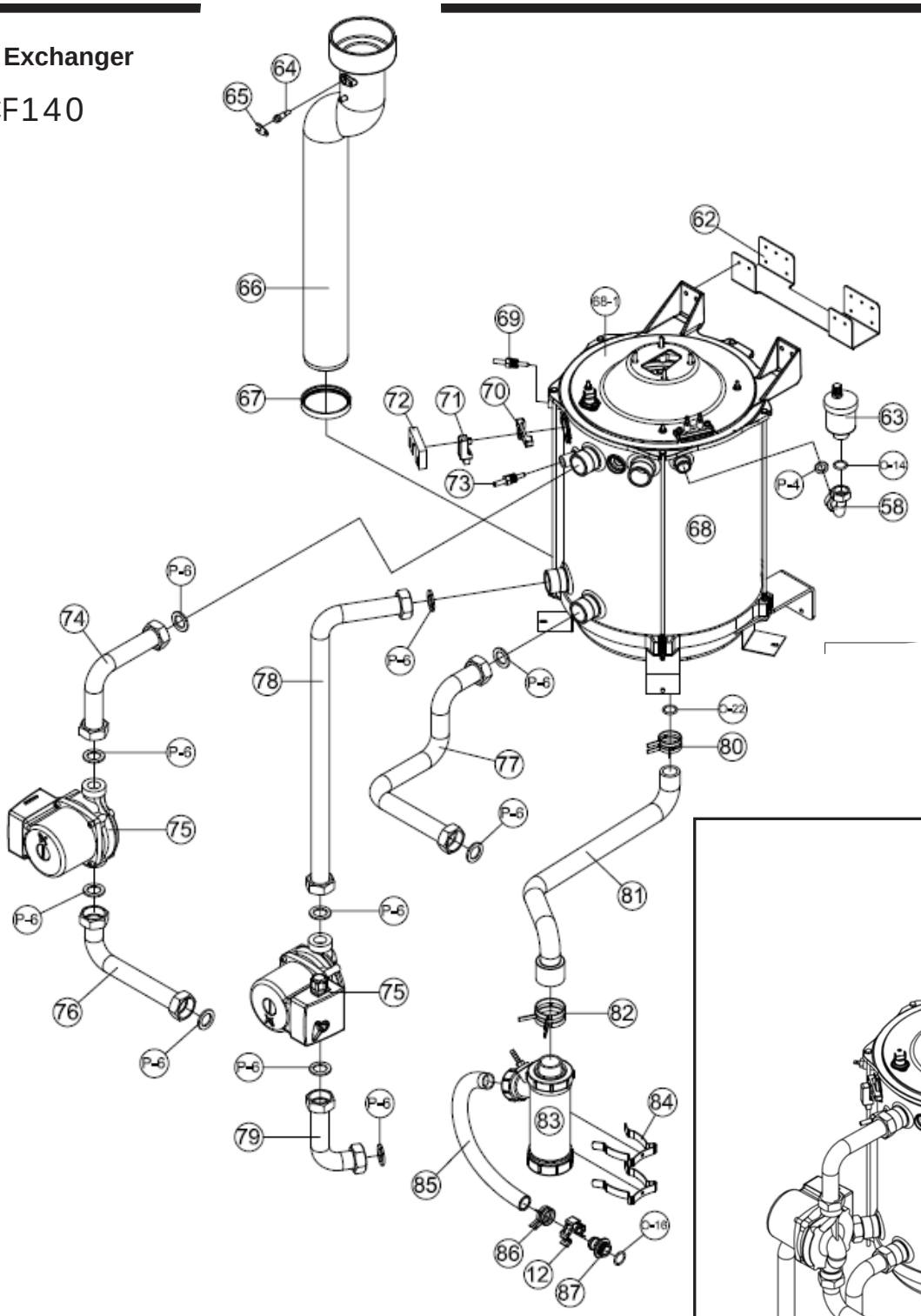
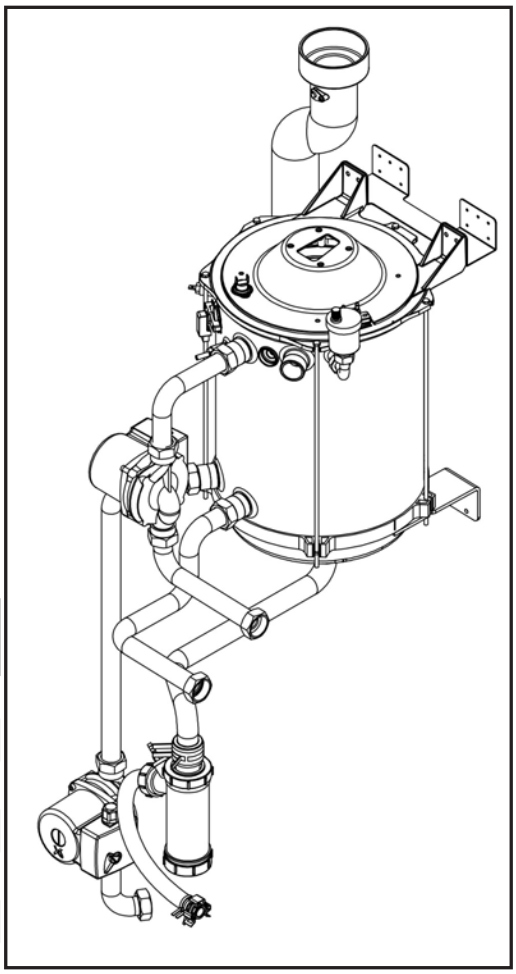
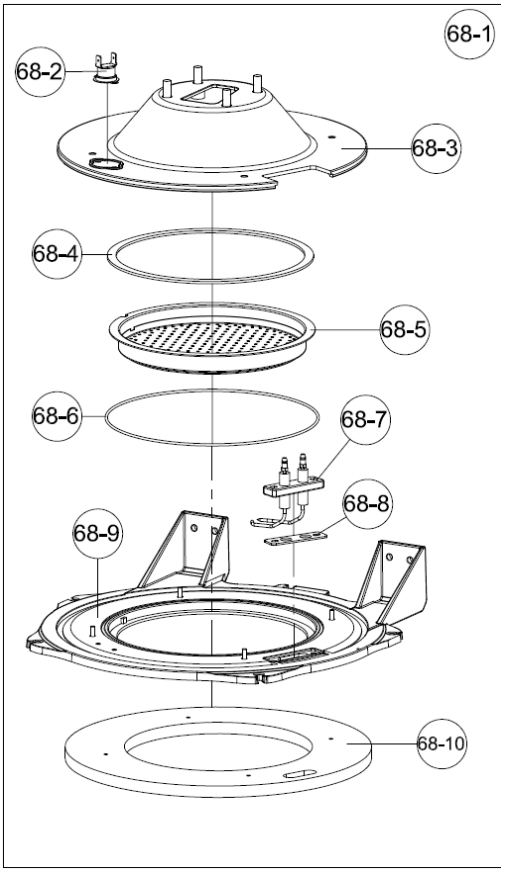




No.	Description	Part Number
O-14	O-Ring P14	FT1642
O-16	O-Ring P16	FT1643
O-22	O-Ring P22	FT1644
P-4	1/2" Packing	FT1645
P-6	1" Packing	FT1691
12	Flow sensor clip	FT1208
58	Elbow Pipe connector 1	FT1648

No.	Description	Part Number
62	Heat Exchanger BK	FT1649
63	Air Vent	FT1321
64	Exhaust overheat sensor	FT1307
65	Exhaust sensor bracket	FT1529
66	Exhaust pipe	FT1654
67	Exhaust pipe packing (lower)	FT1666
68	Heat Exchanger Ass'y	FT1655
68-1	Burner Ass'y	FT1309
68-2	Overheat sensor	FT1310
68-3	Burner upper case	FT1658
68-4	Ceramic paper	FT1659
68-5	Burner	FT1314
68-6	Burner case sealing O-Ring	FT1661
68-7	Ignition rod	FT1315
68-8	Ignition rod gasket	FT1316
68-9	Burner downside case	FT1664
68-10	Refractory	FT1665
69	Low level sensor	FT1325
70	Flame detector sensor bracket	FT1669
71	Flame detector sensor	FT1327
72	Flame detector sensor cover	FT1069
73	Temperature sensor	FT1324
74	Pipe for internal circulation (upper)	FT1671
75	Pump	FT1672
76	Pipe for internal circulation (below)	FT1673
77	CH return pipe (below)	FT1675
78	CH outlet pipe (upper)	FT1674
79	CH outlet pipe (below)	FT1676
80	Clamp (Ø34)	FT1677
81	Condensate trap hose	FT1678
82	Clamp (Ø40)	FT1679
83	Condensate trap Ass'y	FT1328
84	Condensate bracket	FT1845
85	Condensate outlet hose	FT1681
86	Clamp (Ø23)	FT1682
87	Condensate outlet fitting	FT1683



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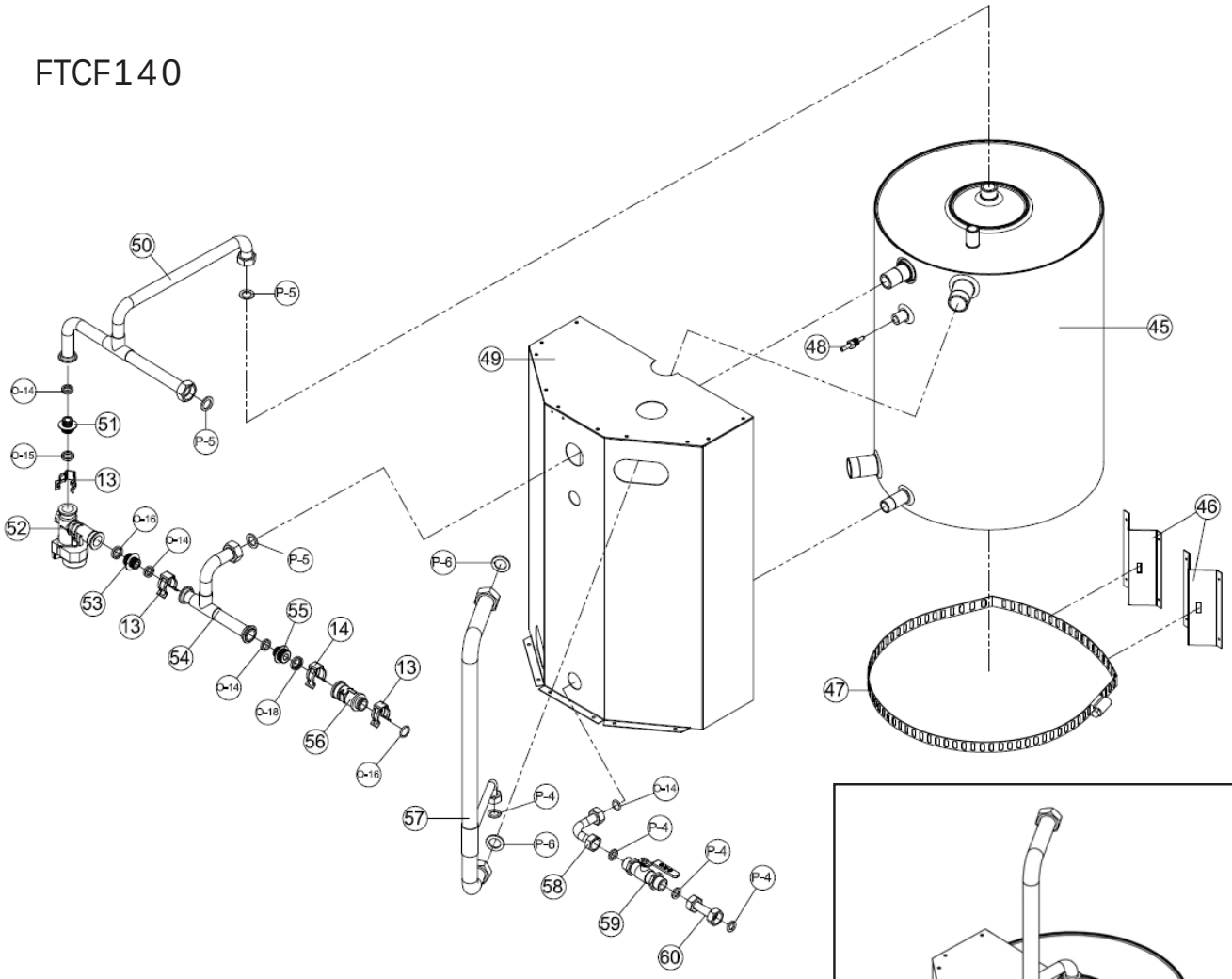
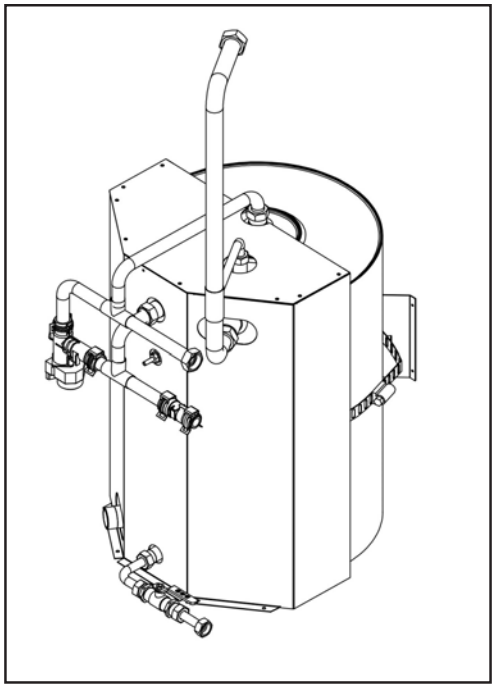
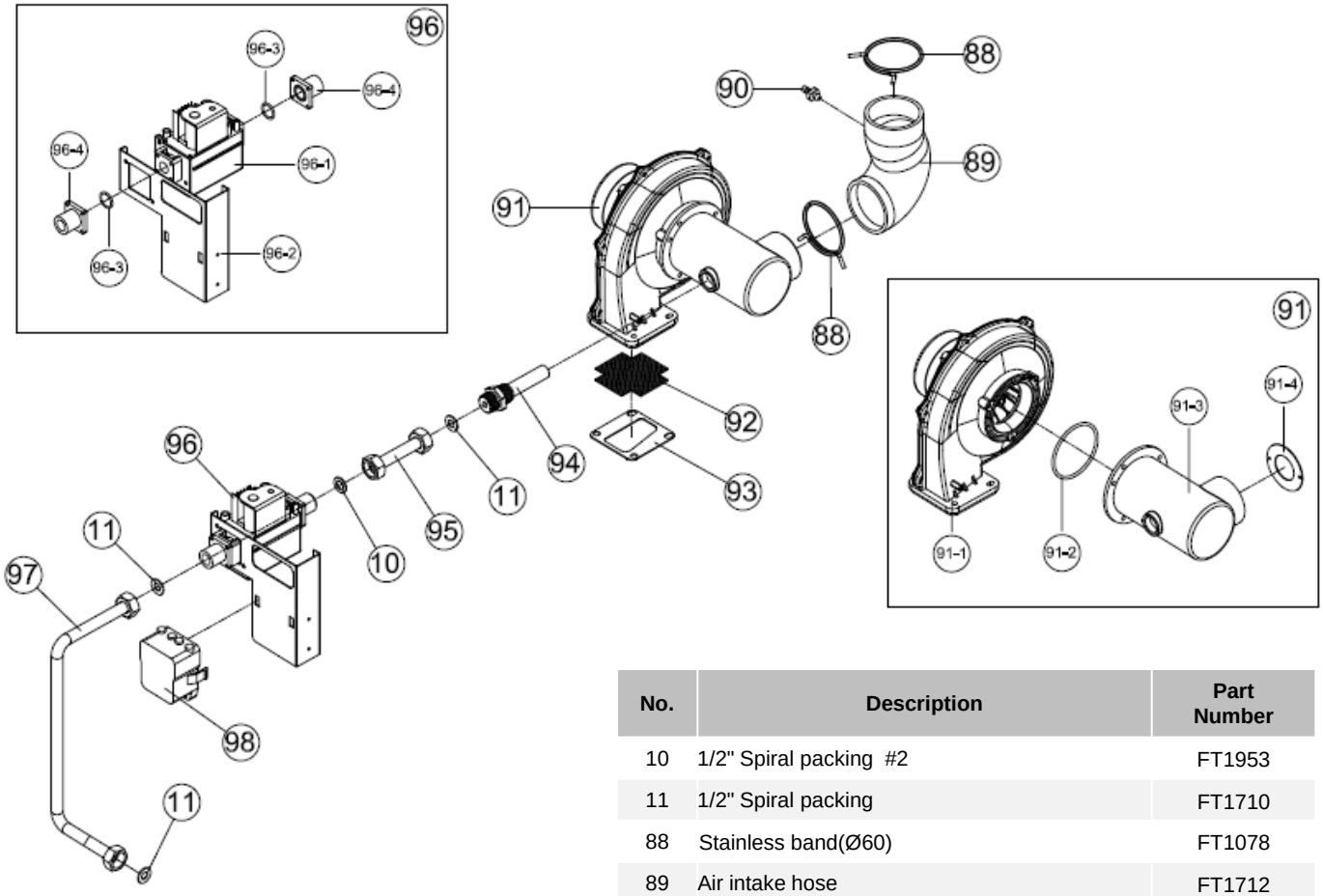


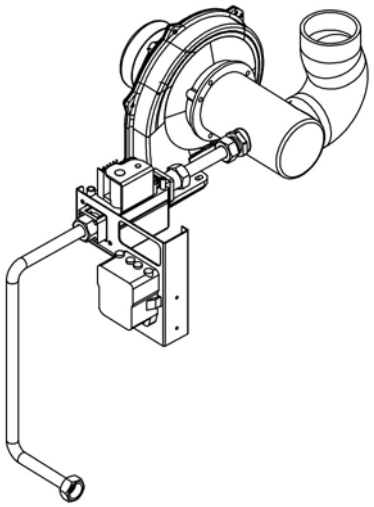


No.	Description	Part Number
O-14	O-Ring P14	FT1642
O-15	O-Ring P15	FT1685
O-16	O-Ring P16	FT1643
O-18	O-Ring P18	FT1687
P-4	1/2" Packing	FT1645
P-5	3/4" Packing	FT1646
P-6	1" Packing	FT1691
13	Clip for Cold water inlet 1	FT1692
14	Clip for Cold water inlet 2	FT1693
45	DHW Tank	FT1694
46	DHW Tank bracket	FT1696
47	Stainless band(Ø415)	FT1697
48	DHW Tank temperature sensor	FT1695
49	DHW Tank cover Ass'y	FT1698
50	DHW Outlet Pipe	FT1699
51	15 O-Ring adapter	FT1700
52	Mixing valve	FT1701
53	16 O-Ring adapter	FT1702
54	DHW inlet Pipe	FT1703
55	18 O-Ring adapter	FT1704
56	Flow sensor	FT1115
57	DHW Tank outlet pipe	FT1706
58	Elbow Pipe connector 1	FT1648
59	Drain valve	FT1708
60	Drain pipe connector 2	FT1709

Blower

FTCF140

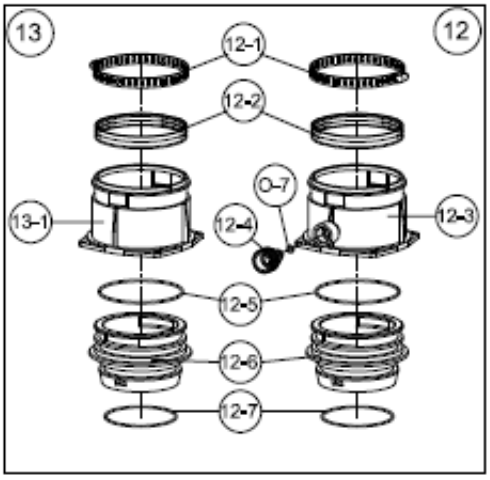




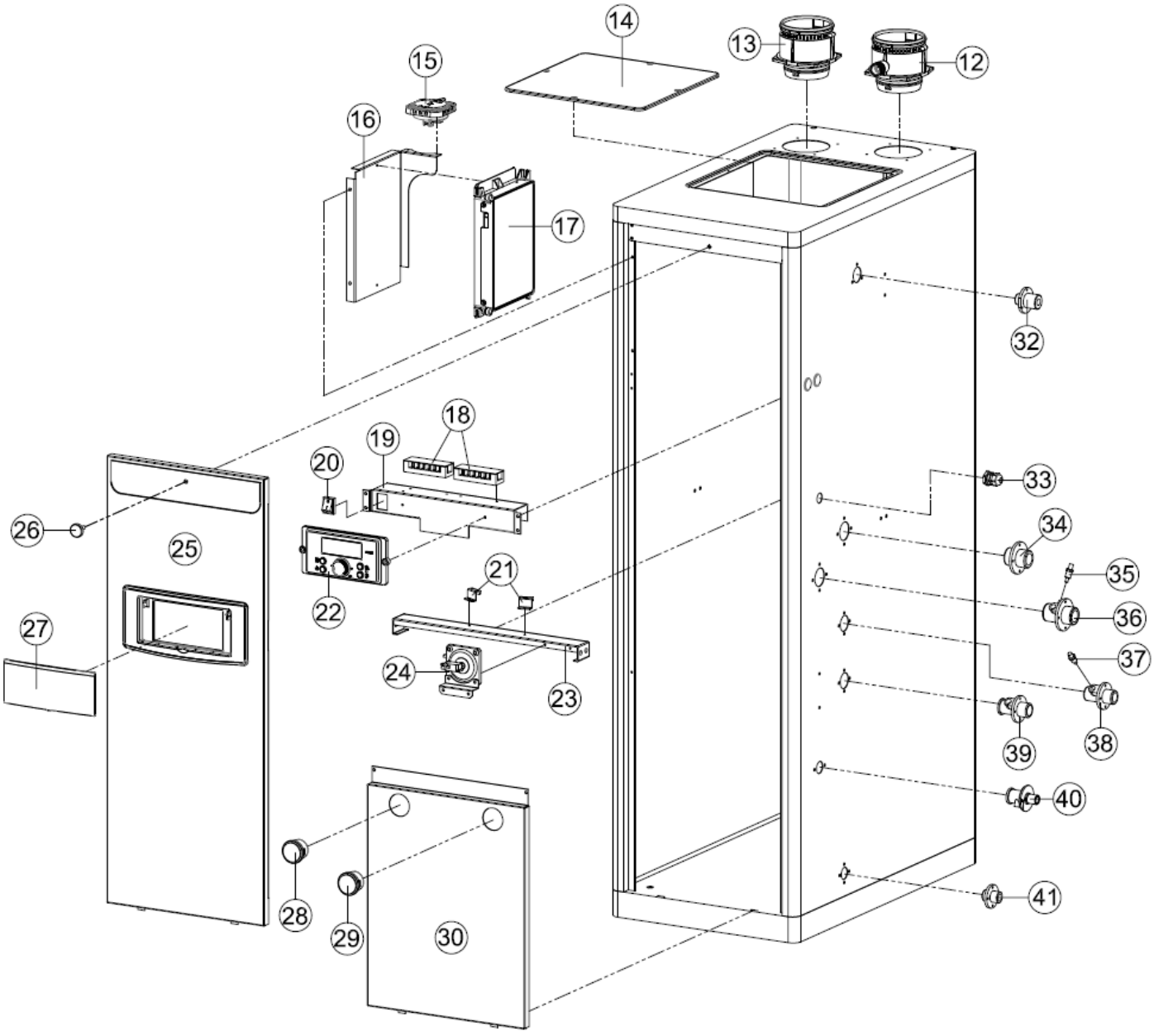
No.	Description	Part Number
10	1/2" Spiral packing #2	FT1953
11	1/2" Spiral packing	FT1710
88	Stainless band(Ø60)	FT1078
89	Air intake hose	FT1712
90	Intake silicon adaptor	FT1713
91	Fan Ass'y	FT1714
91-1	Fan	FT1715
91-2	Fan sealing O-Ring	ST1038
91-3	Gas mixer housing	FT1409
91-4	Intake orifice	FT1718
92	Mesh	FT1720
93	Fan rubber packing(1.0t)	FT1721
94	Nozzle Ass'y(LNG)	FT1412N5
	Nozzle Ass'y(LPG)	FT1412P5
95	Gas pipe (upper)	FT1723
96	Gas Valve Ass'y	FT1724
96-1	Gas Valve	FT1416
96-2	Gas valve bracket	FT1726
96-3	Gas valve O-Ring	FT1727
96-4	Gas valve inlet adaptor	FT1538
97	Gas pipe (below)	FT1729
98	Ignition Transformer	ST1006

CASE

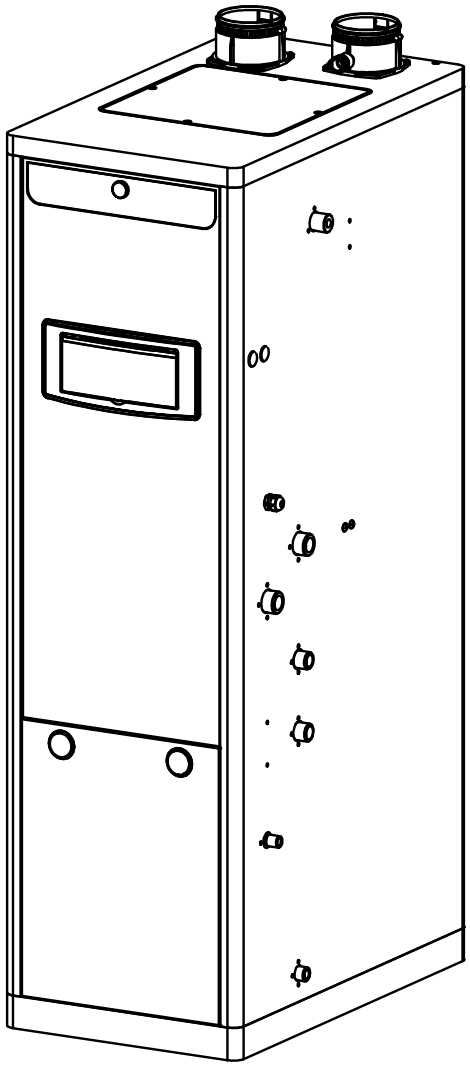
FTCF199



No.	Description	Part Number
O-7	O-Ring P7	FT1601
12	Exhaust vent duct Assembly	FT1002
12-1	Stainless band (Ø100)	FT1603
12-2	Packing	FT1604
12-3	Exhaust vent duct	FT1611
12-4	Exhaust testing cap	FT1606
12-5	O-Ring P85	FT1607
12-6	Exhaust vent adaptor (Inside)	FT1608
12-7	O-Ring P75	FT1609



No.	Description	Part Number
13	Air inlet duct Assembly	FT1909
13-1	Air inlet duct	FT1605
14	Upper AS Cover	FT1891
15	Air pressure sensor (80)	FT1804
16	Control bracket	FT1617
17	PCB Control (GTX-920CP)	FT1898
18	Terminal block (6p)	FT1827
19	Control sub bracket	FT1619
20	Power switch	FT1020
21	Condensate body fix bracket	FT1828
22	Display Control (P-920C)	FT1019
23	Bracket	FT1910
24	Condensate blockage, Air pressure switch	FT1022
25	Front Cover (Upper)	FT1911
26	Casing Bolt	FT1830
27	Control display cover / window	FT1024
28	Pressure gauge 150psi	FT1628
29	Pressure gauge 60psi	FT1629
30	Front cover (Down)	FT1831
32	Gas inlet adaptor	FT1889
33	Cable gland	FT1633
34	CH supply connector	FT1634
35	CH Return sensor	FT1635
36	CH return adaptor	FT1636
37	DHW Outlet sensor	FT1638
38	DHW outlet adaptor	FT1637
39	DHW inlet connector	FT1639
40	Stainless connector	FT1892
41	Drain Adaptor	FT1641



Heat Exchanger

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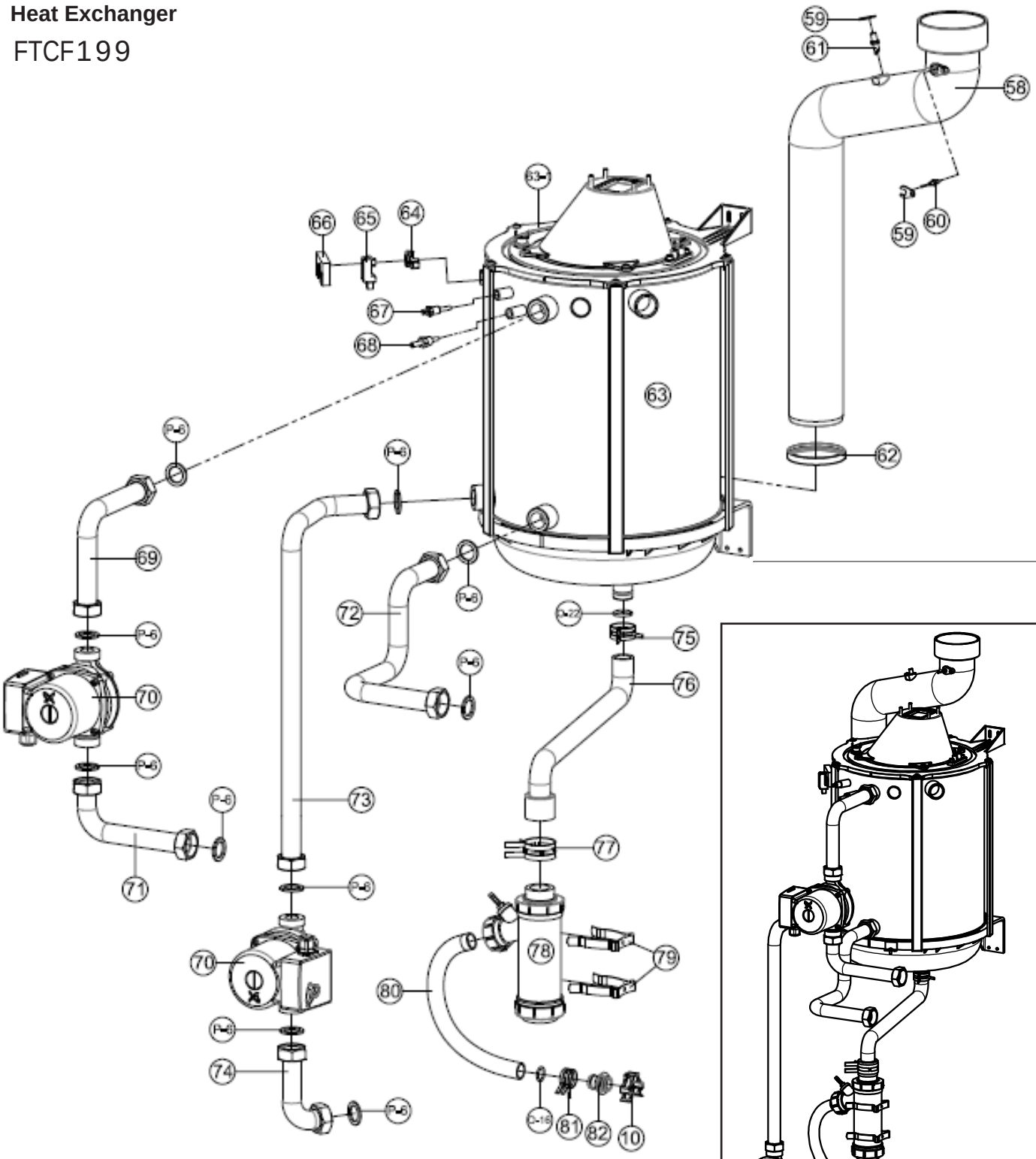
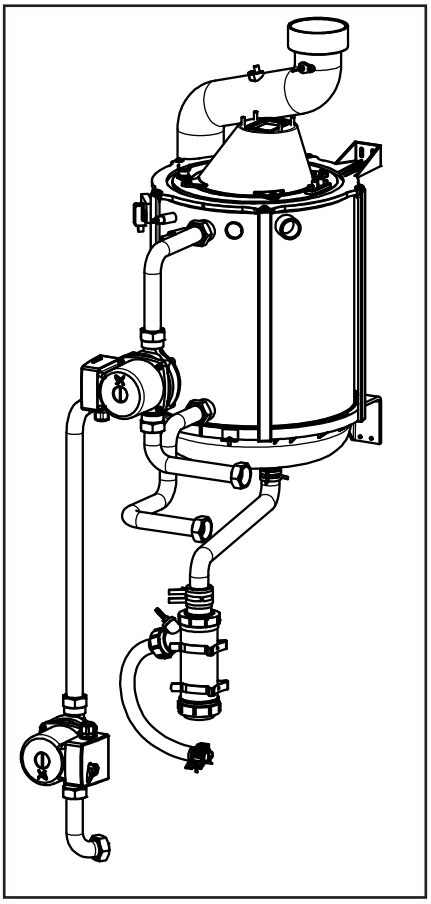
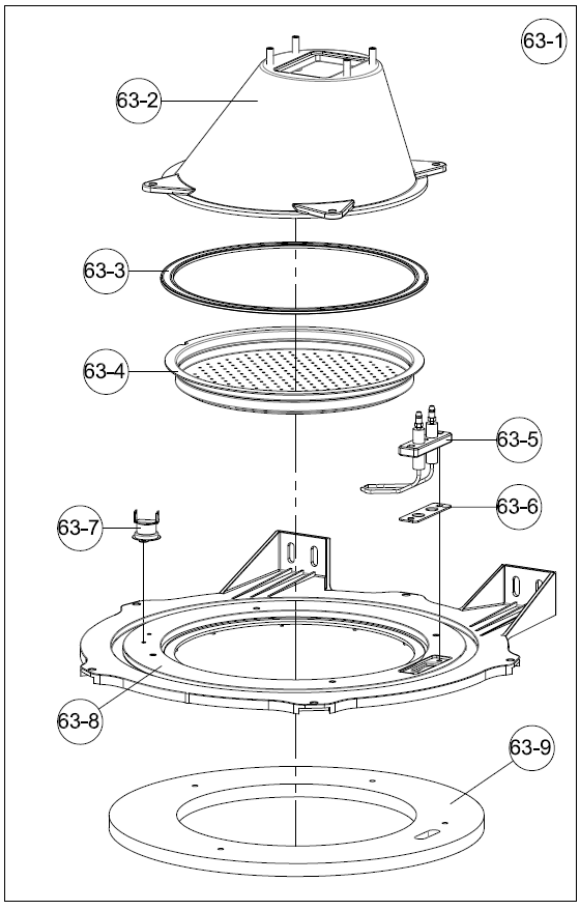
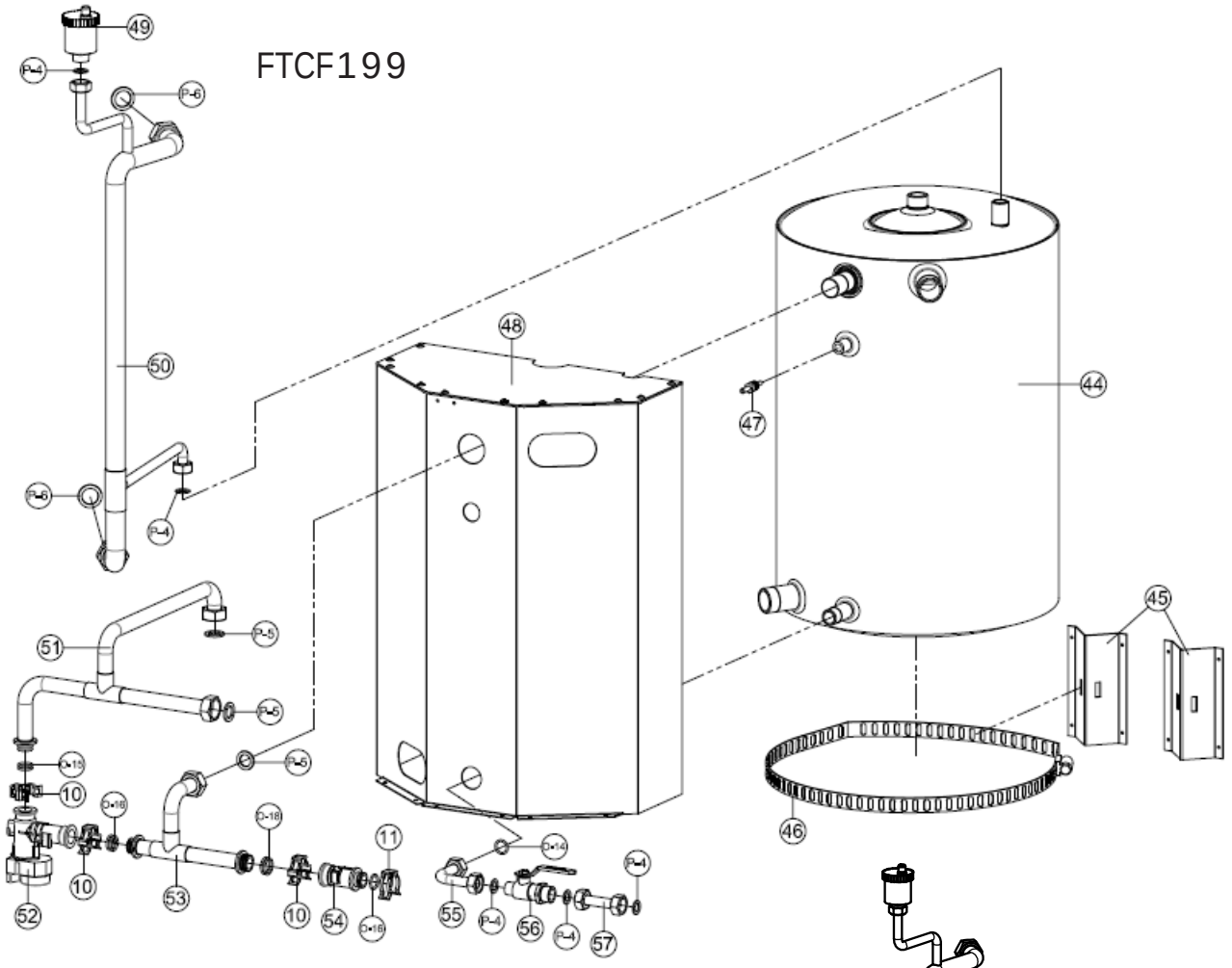




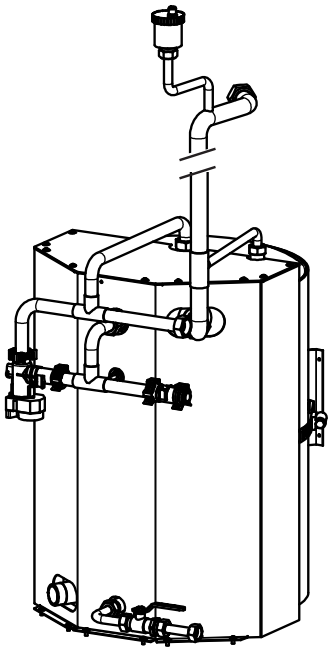
No.	Description	Part Number
O-16	O-Ring P16	FT1643
O-22	O-Ring P22	FT1644
P-6	1" Packing	FT1691
10	Flow Sensor Clip	FT1208

	Description	Part Number
58	Exhaust Pipe	FT1823
59	Exhaust sensor bracket	FT1529
60	Exhaust overheat sensor	FT1307
61	EX-Adaptor	FT1784
62	Exhaust pipe packing (lower)	FT1836
63	Heat Exchanger Assembly	FT1837
63-1	Burner Assembly	FT1796
63-2	Burner upper case	FT1760
63-3	Burner gasket	FT1824
63-4	Burner	FT1762
63-5	Ignition rod	FT1763
63-6	Ignition rod Gasket	FT1316
63-7	Overheat sensor	FT1310
63-8	Burner downside case	FT1764
63-9	Refractory	FT1826
64	Flame detector sensor bracket	FT1669
65	Flame detector sensor	FT1327
66	Flame detector sensor cover	FT1069
67	Low level sensor	FT1325
68	Temperature sensor	FT1324
69	Pipe for internal circulation (upper)	FT1914
70	Pump	FT1767
71	Pipe for internal circulation (below)	FT1840
72	CH return pipe (below)	FT1841
73	CH outlet pipe (upper)	FT1842
74	CH outlet pipe (below)	FT1843
75	Clamp (Ø34)	FT1677
76	Condensate trap hose	FT1844
77	Clamp (Ø40)	FT1679
78	Condensate trap Assembly	FT1328
79	Condensate bracket	FT1845
80	Condensate outlet hose	FT1681
81	Clamp (Ø23)	FT1682
82	Condensate outlet fitting	FT1683





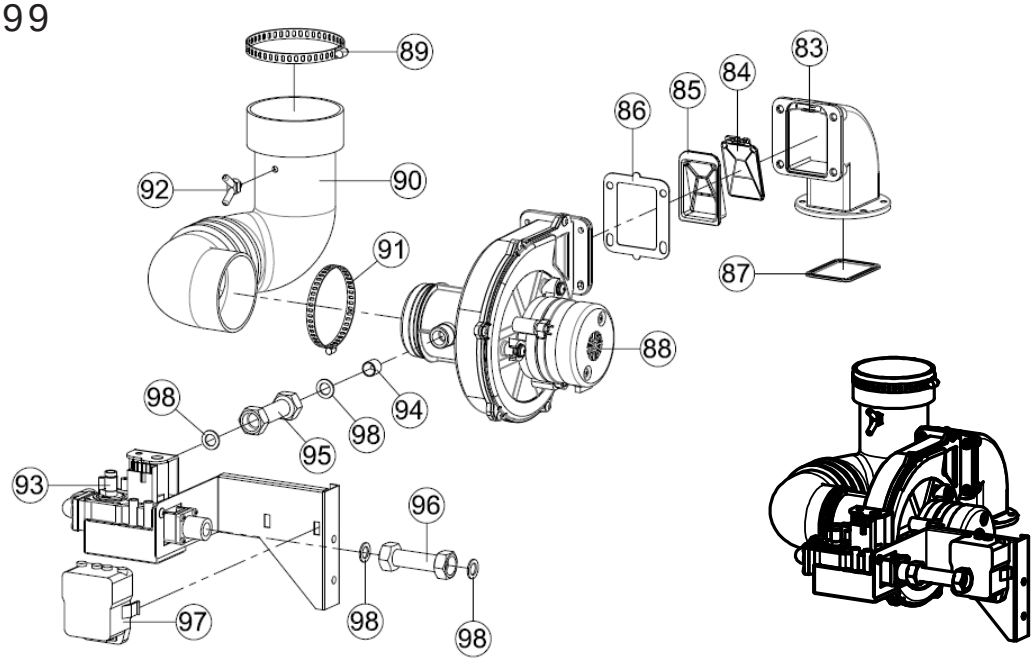
No.	Description	Part Number
O-15	O-Ring P15	FT1685
O-16	O-Ring P16	FT1643
O-18	O-Ring P18	FT1687
P-4	1/2" Packing	FT1645
P-5	3/4" Packing	FT1646
P-6	1" Packing	FT1691
10	Flow Sensor Clip	FT1208
11	Clip for Cold water inlet 1	FT1692
44	DHW Tank	FT1912
45	DHW Tank bracket	FT1696
46	Stainless band (Ø415)	FT1697
47	DHW Tank temperature sensor	FT1695
48	DHW Tank cover Assembly	FT1913
49	Air vent	FT1321
50	DHW Tank outlet pipe	FT1833
51	DHW Outlet Pipe	FT1834

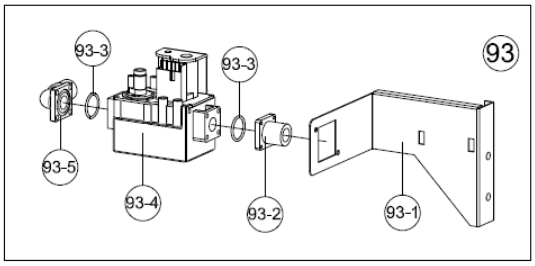


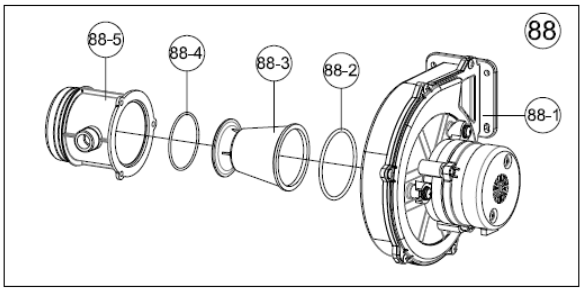
52	Mixing valve	FT1116
53	DHW Inlet pipe	FT1835
54	Flow sensor	FT1115
55	Elbow Pipe connector 1	FT1648
56	Drain valve	FT1708
57	Drain pipe connector 2	FT1709

Blower

FTCF199







No.	Description	Part Number
83	Fan guide	FT1769
84	Damper packing	FT1770
85	Damper body	FT1915
86	Fan rubber packing (1.6t)	FT1082
87	Fan guide packing	FT1772
88	Fan Assembly	FT1916
88-1	Fan	FT1406
88-2	Fan sealing O-Ring	ST1038
88-3	AGM venturi	FT1917
88-4	AGM O-ring	FT1774
88-5	AGM body	FT1775
89	Stainless band (Ø100)	FT1603
90	Air intake hose	FT1846
91	Stainless band (Ø89)	FT1777

No.	Description	Part Number
92	Nylon Barb Y Fitting	FT1918
93	Gas valve Assembly	FT1847
93-1	Gas valve bracket	FT1848
93-2	Gas valve inlet adaptor	FT1538
93-3	Gas valve O-Ring	FT1727
93-4	Gas valve	FT1416
93-5	Gas valve outlet adaptor	FT1919
94	Nozzle (natural)	FT1780
	Nozzle (propane)	FT1802
95	Gas pipe (left)	FT1849
96	Gas pipe (right)	FT1850
97	Ignition transformer	ST1006
98	1/2" Spiral packing	FT1710

Notes:

For Product and Service VIDEOS

Dimensions and specifications subject to change without notice in accordance with our policy of continuous product improvement.

H2373000D

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