



Installation and Operation Instructions for

FT SERIES

Wall-Mounted, Modulating
Gas, Condensing, Heating Only, Boiler

Model FTHW 100,000 BTU/h
140,000 BTU/h
199,000 BTU/h



Intertek

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

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

⚠ WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

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

WHAT TO DO IF YOU SMELL GAS

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

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

⚠ AVERTISSEMENT

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

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

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

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

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

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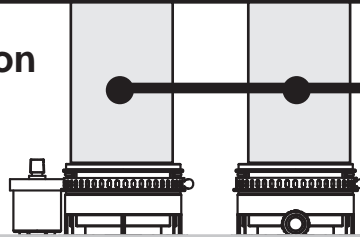
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SECTION 1 Introduction

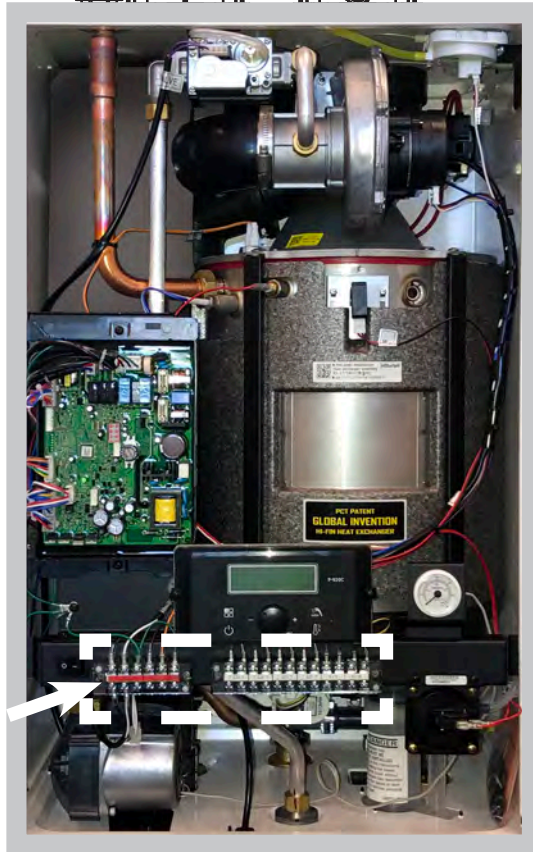
1.1 About this Installation Manual

This manual provides the information necessary for the installation, operation, and maintenance of the **FT Series Wall Mounted, Heat Only Boiler**.

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



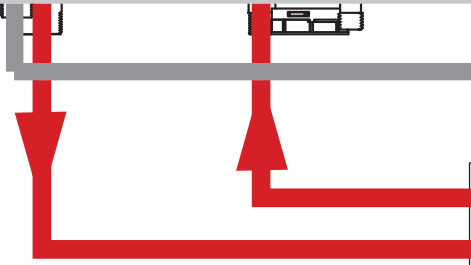
For details on Combustion Air and Venting, See page 19 through to page 27



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

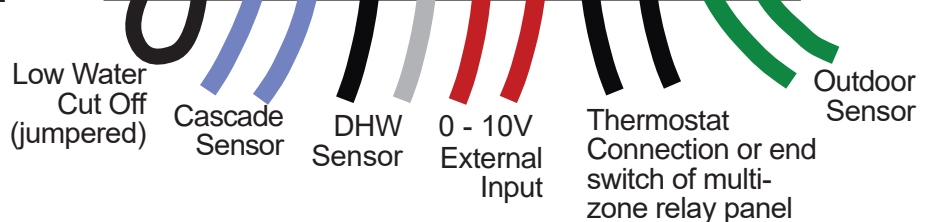
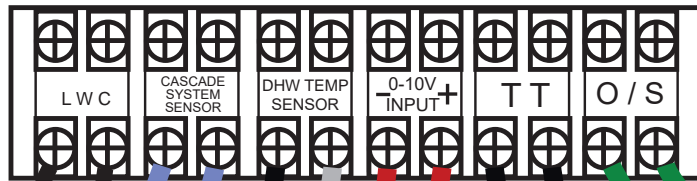
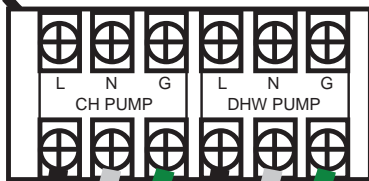
All electrical wiring is to be done in accordance with the local codes, or in the absence of local codes, with: 1) The National Electrical Code ANSI/NFPA No. 70-latest Edition, or 2) CSA STD. C22.1 "Canadian Electrical Code - Part 1". This appliance must be electrically grounded in accordance with these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

For details on Gas Connections, See page 30 through to page 38


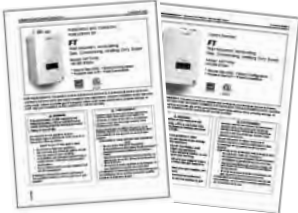







For details on Plumbing for Central Heat and Condensate, See page 42 through to page 48




For details on Electrical Connections, See page 49 through to page 53



1.2 Included in the Box

Item	Description	Qty
<p>Wall Mounted Boiler FTHW (all sizes)</p>		<p>1</p>
<p>Installation Instructions and User's Manual</p>		<p>1</p>
<p>Condensate Hose</p>		<p>1</p>
<p>Wall Mount Bracket</p>		<p>1</p>
<p>2 types of Wall Anchors</p>		<p>1</p>
<p>Pressure Relief Valve (CH LINE 3/4" 30psi) Model: CASH ACME F-82</p>		<p>1</p>
<p>Mesh Screens 3"</p>		<p>2</p>

1.2 Included in the Box (continued)

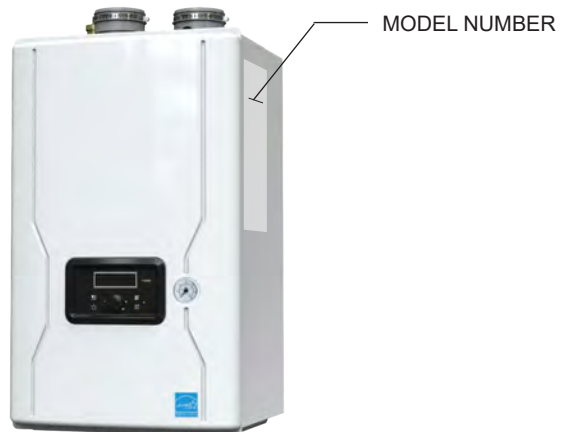
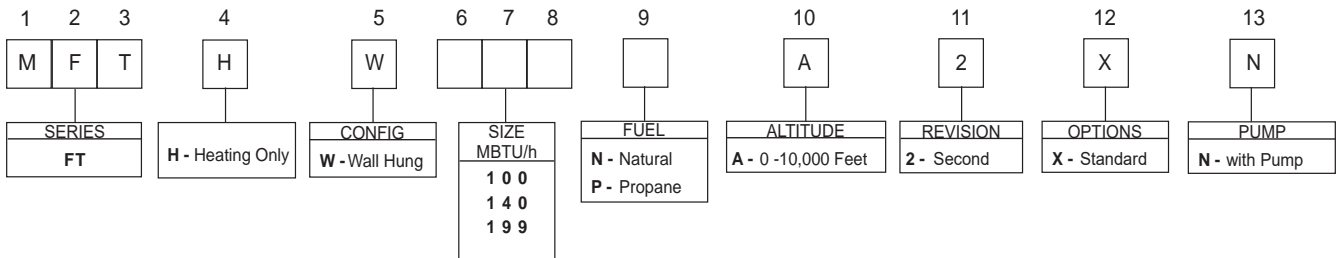
Items	Descriptions	Qty
Propane Conversion Orifice		1
O-Ring and Gasket Kit		1
Outdoor Temperature Sensor with anchors and screws		

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 Series Boiler.



2.2 Specifications, 100 MBH

Model Name		FTHW100	
Gas Input Rate	MAX	100,000 Btu/h	
	MIN	20,000 Btu/h	
Installation		Indoor / Wall hung type	
Flue System		Sealed Combustion Direct / Single Vent / Sidewall Vent	
Vent Run / Vent Material		2"(50ft), 3"(100ft) Schedule 40 CPVC, PP, PVC	
Orifice Size	NG	0.181" (4.6 mm)	
	LP	0.142" (3.6 mm)	
Gas Supply Pressure	NG	3.5" WC to 10.5" WC	
	LP	8.0" WC to 13.0" WC	
Manifold Pressure	Gas type	LP	NG
	Max fire	-0.075" WC (+/- 0.01)	-0.070" WC (+/- 0.01)
	Min fire	0.003" WC (+/-0.001)	0.000" WC (+/- 0.001)
Power Supply	Main Supply	120V 60Hz / 4A	
	Maximum Power Consumption	160W	
Ignition System		Direct Electronic Ignition / Automatic Flame Sensing	
Burner System		Single Orifice Premixed Fuel Modulation Metal Ceramic Infrared	
Gas Valve System		Combination modulating (Current proportional)	
Dimensions		W17 3/8" - H29" - D15 1/2"	
Shipping Weight		98 lbs (44 kg)	
Main Controller / Control Display		NGTB-900CP / P-950EH	
Water Pressure		CH Min 15 ~ Max 30 PSI	
Connection Sizes	CH Supply/Return	1 1/4" NPT	
	Gas Inlet	3/4" NPT	
Materials	Casing	Cold Rolled Carbon Steel	
	Heat Exchanger	Primary Heat Exchanger : Stainless Steel Sub Heat Exchanger : Stainless Steel	
Safety Devices		Optical Flame Sensor, Low Water Cut Off Sensor, Flue Gas Limit Sensor, Overheat Cut Off Device, Gas Valve Operation Detector, Water Temperature Sensor, Over-heat Limit Switch, Air Pressure Sensor	

2.2 Specifications, 140 MBH

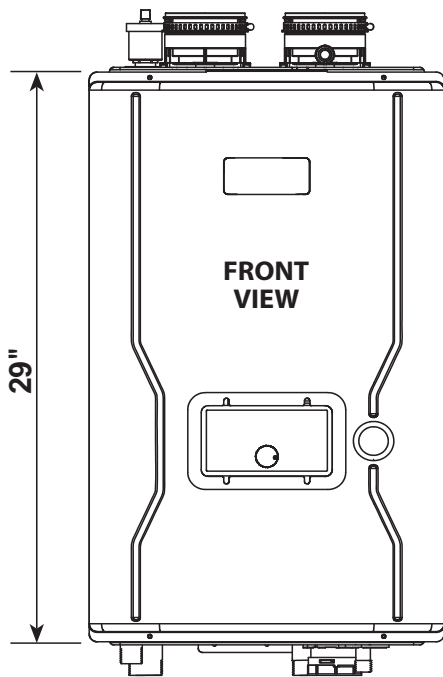
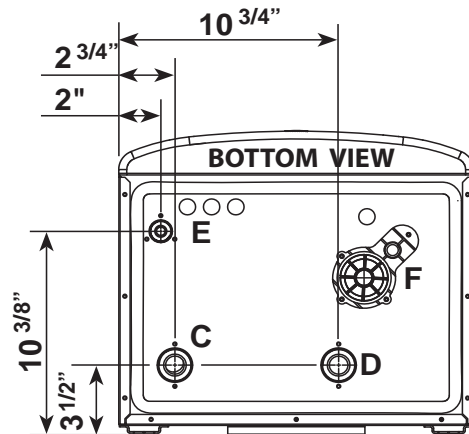
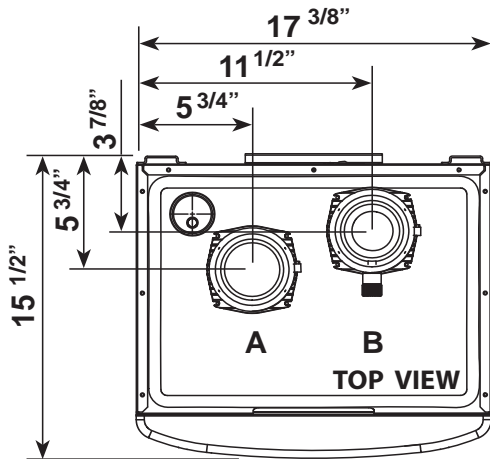
Model Name		FTHW140	
Gas Input Rate	MAX	140,000 Btu/h	
	MIN	14,000 Btu/h	
Installation		Indoor / Wall hung type	
Flue System		Sealed Combustion Direct / Single Vent / Sidewall Vent	
Vent Run / Vent Material		2"(50ft), 3"(100ft) Schedule 40 CPVC, PP, PVC	
Orifice Size	NG	0.244" (6.2 mm)	
	LP	0.185" (4.7 mm)	
Gas Supply Pressure	NG	3.5" WC to 10.5" WC	
	LP	8.0" WC to 13.0" WC	
Manifold Pressure	Gas type	LP	NG
	Max fire	-0.130" WC (+/- 0.01)	-0.100" WC (+/- 0.01)
	Min fire	0.004" WC (+/- 0.001)	0.002" WC (+/- 0.001)
Power Supply	Main Supply	120V 60Hz / 4A	
	Maximum Power Consumption	160W	
Ignition System		Direct Electronic Ignition / Automatic Flame Sensing	
Burner System		Single Orifice Premixed Fuel Modulation Metal Ceramic Infrared	
Gas Valve System		Combination modulating (Current proportional)	
Dimensions		W17 3/8" - H29" – D15 1/2"	
Shipping Weight		102 lbs (46 kg)	
Main Controller / Control Display		NGTB-900CP / P-950EH	
Water Pressure		CH Min 15 ~ Max 30 PSI	
Connection Sizes	CH Supply/Return	1 1/4" NPT	
	Gas Inlet	3/4" NPT	
Materials	Casing	Cold Rolled Carbon Steel	
	Heat Exchanger	Primary Heat Exchanger : Stainless Steel Sub Heat Exchanger : Stainless Steel	
Safety Devices		Optical Flame Sensor, Low Water Cut Off Sensor, Flue Gas Limit Sensor, Overheat Cut Off Device, Gas Valve Operation Detector, Water Temperature Sensor, Over-heat Limit Switch, Air Pressure Sensor	

2.2 Specifications, 199 MBH

Model Name		FTHW199	
Gas Input Rate	MAX	199,000 Btu/h	
	MIN	19,900 Btu/h	
Installation		Indoor / Wall hung type	
Flue System		Sealed Combustion Direct / Single Vent / Concentric Vent	
Vent Run / Vent Material		2"(50ft), 3"(100ft) Schedule 40 CPVC, PP, PVC	
Orifice Size	NG	0.326" (8.3mm)	
	LP	0.250" (6.35 mm)	
Gas Supply Pressure	NG	3.5" WC to 10.5" WC	
	LP	8.0" WC to 13.0" WC	
Manifold Pressure	Gas type	LP	NG
	Max fire	-0.169" WC (+/- 0.01)	-0.129" WC (+/- 0.01)
	Min fire	-0.015" WC (+/- 0.001)	-0.015" WC (+/- 0.001)
Power Supply	Main Supply	120V 60Hz / 4A	
	Maximum Power Consumption	160W	
Ignition System		Direct Electronic Ignition / Automatic Flame Sensing	
Burner System		Single Orifice Premixed Fuel Modulation Metal Ceramic Infrared	
Gas Valve System		Combination modulating (Current proportional)	
Dimensions		W19 3/4" - H32" - D16 7/8"	
Shipping Weight		118 lbs (54 kg)	
Main Controller / Control Display		NGTB-900CP / P-950EH	
Water Pressure		Min 15 ~ Max 30 PSI	
Connection Sizes	CH Supply/Return	1 1/4" NPT	
	Gas Inlet	3/4" NPT	
Materials	Casing	Cold Rolled Carbon Steel	
	Heat Exchanger	Primary Heat Exchanger : Stainless Steel Sub Heat Exchanger : Stainless Steel	
Safety Devices		Optical Flame Sensor, Low Water Cut Off Sensor, Flue Gas Limit Sensor, Overheat Cut Off Device, Gas Valve Operation Detector, Water Temperature Sensor, Over-heat Limit Switch, Air Pressure Sensor	

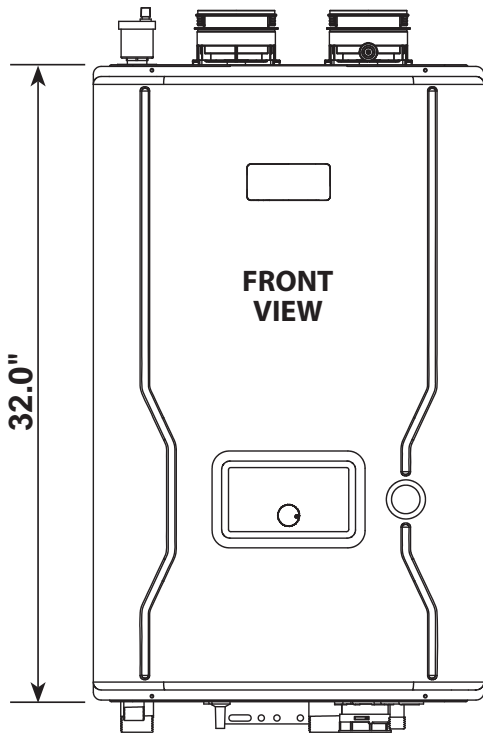
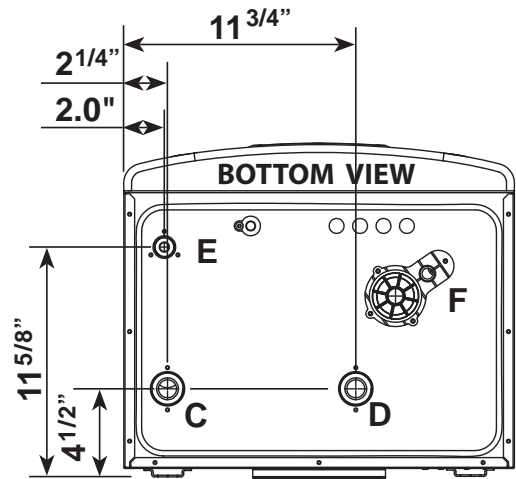
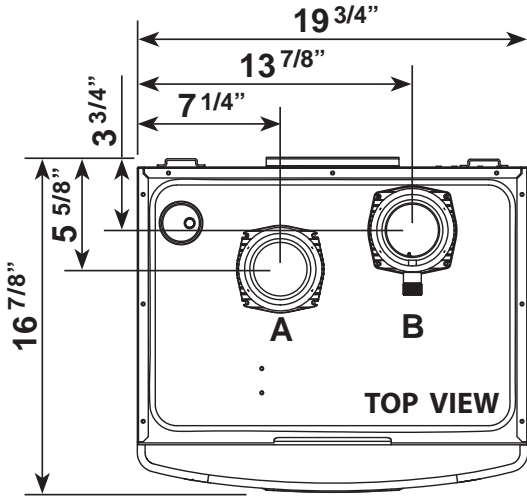
2.3 Dimensions

FTHW 100 / 140 Heating only boiler



	Description	Diameter
A	Air Intake Collar	3"
B	Vent Pipe Collar	3"
C	'CH' Supply	1 1/4"
D	'CH' Return	1 1/4"
E	Gas Inlet	3/4"
F	Condensate Line	1/2"

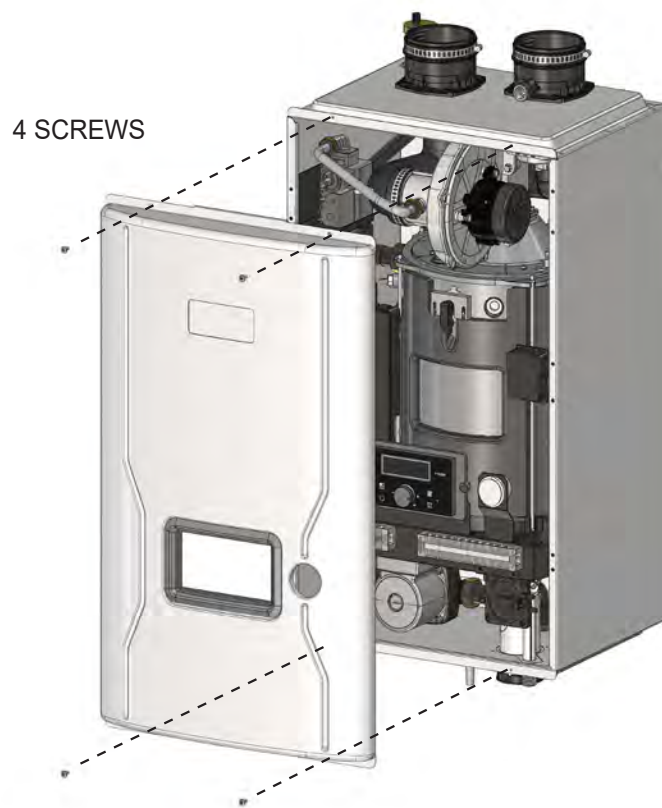
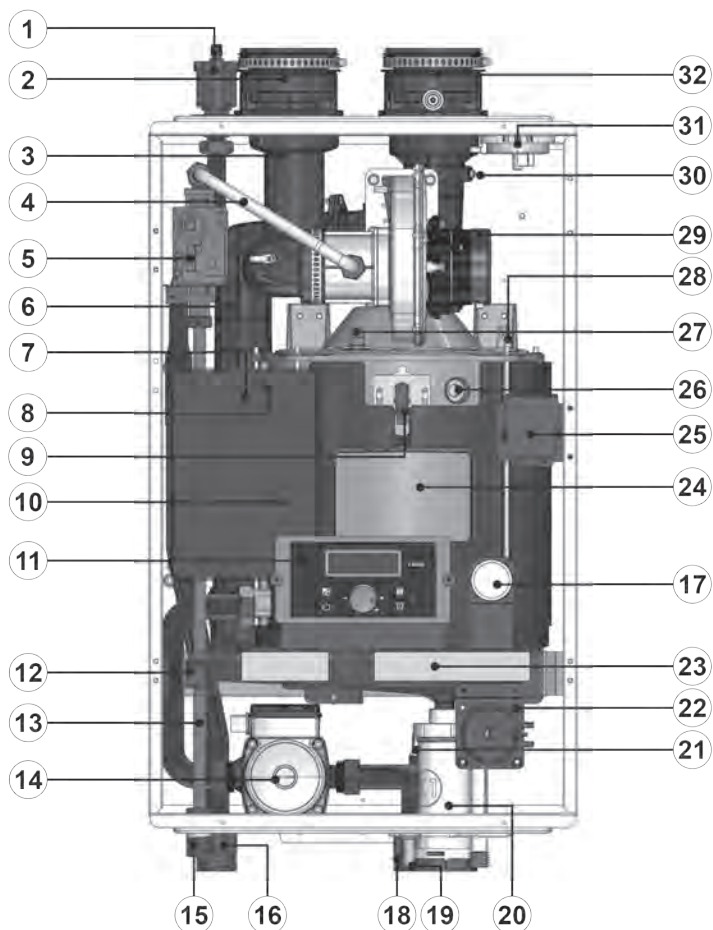
2.3 Dimensions FTHW 199 Heating only boiler



	Description	Diameter
A	Air Intake Collar	3"
B	Vent Pipe Collar	3"
C	'CH' Supply	1 1/4"
D	'CH' Return	1 1/4"
E	Gas Inlet	3/4"
F	Condensate Line	1/2"

2.4 Names of Components

FTHW 100 / 140 Heating only boiler



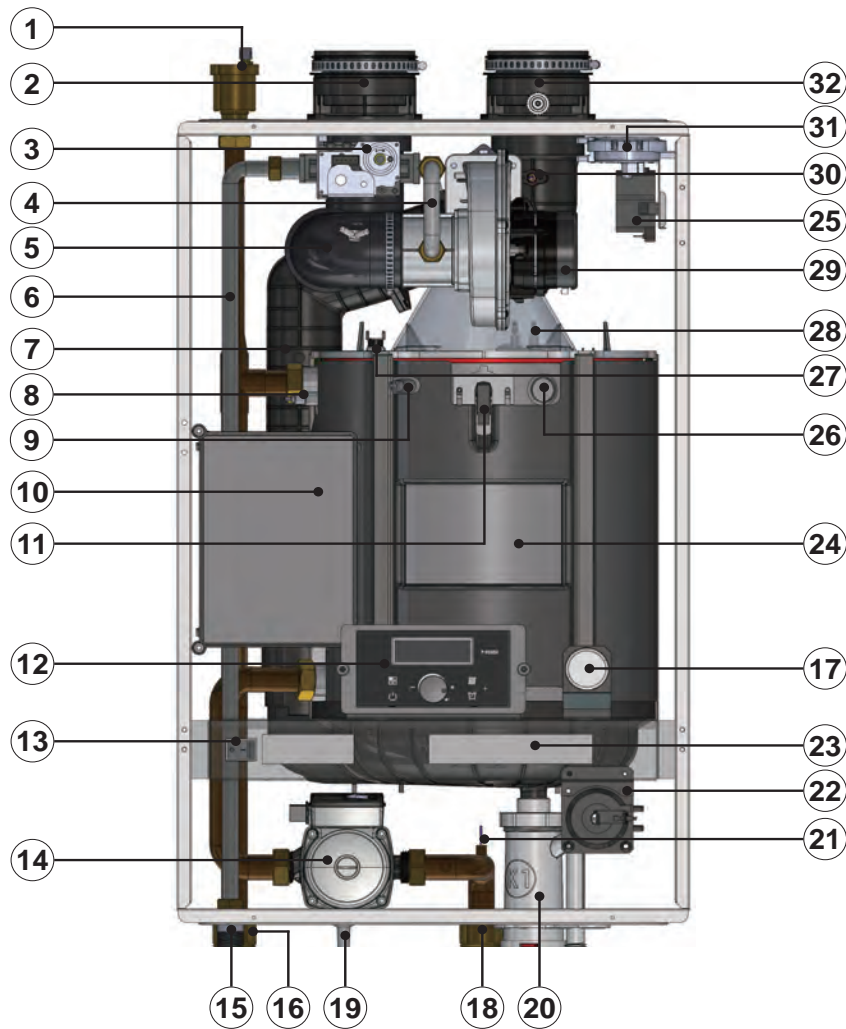
To remove the cover, unthread the 4 phillips head screws. Keep the screws in a safe place for re-application of cover. This is typical for all models of the FT.

NO	Name of Component
1	Air Vent (air eliminator)
2	Air Intake Collar
3	Air / Gas Mixing Pipe
4	Gas Inlet Pipe 2
5	Gas Valve
6	Exhaust Duct
7	Low Water Cut Off
8	Overheat Temperature Sensor
9	Flame Detecting Sensor
10	Main PCB
11	Control Display
12	Manual ON/OFF Power Switch
13	Gas Inlet Pipe 1
14	'CH' Internal Pump
15	Gas Inlet Adapter
16	'CH' Supply Adapter

NO	Name of Component
17	CH Pressure Gauge
18	'CH' Return Adapter
19	Condensate Adapter
20	Condensate Trap
21	CH Return Temperature Sensor
22	Condensate Air Pressure Switch
23	Terminal Block
24	Heat Exchanger
25	Ignition Transformer
26	Sight Glass
27	Burner Overheat Switch
28	Igniter
29	BLDC Fan (blower)
30	Exhaust Temperature Sensor
31	Air Pressure Sensor
32	Vent Pipe Collar

2.4 Names of Components (continued)

FTHW 199 Heating Only Boiler

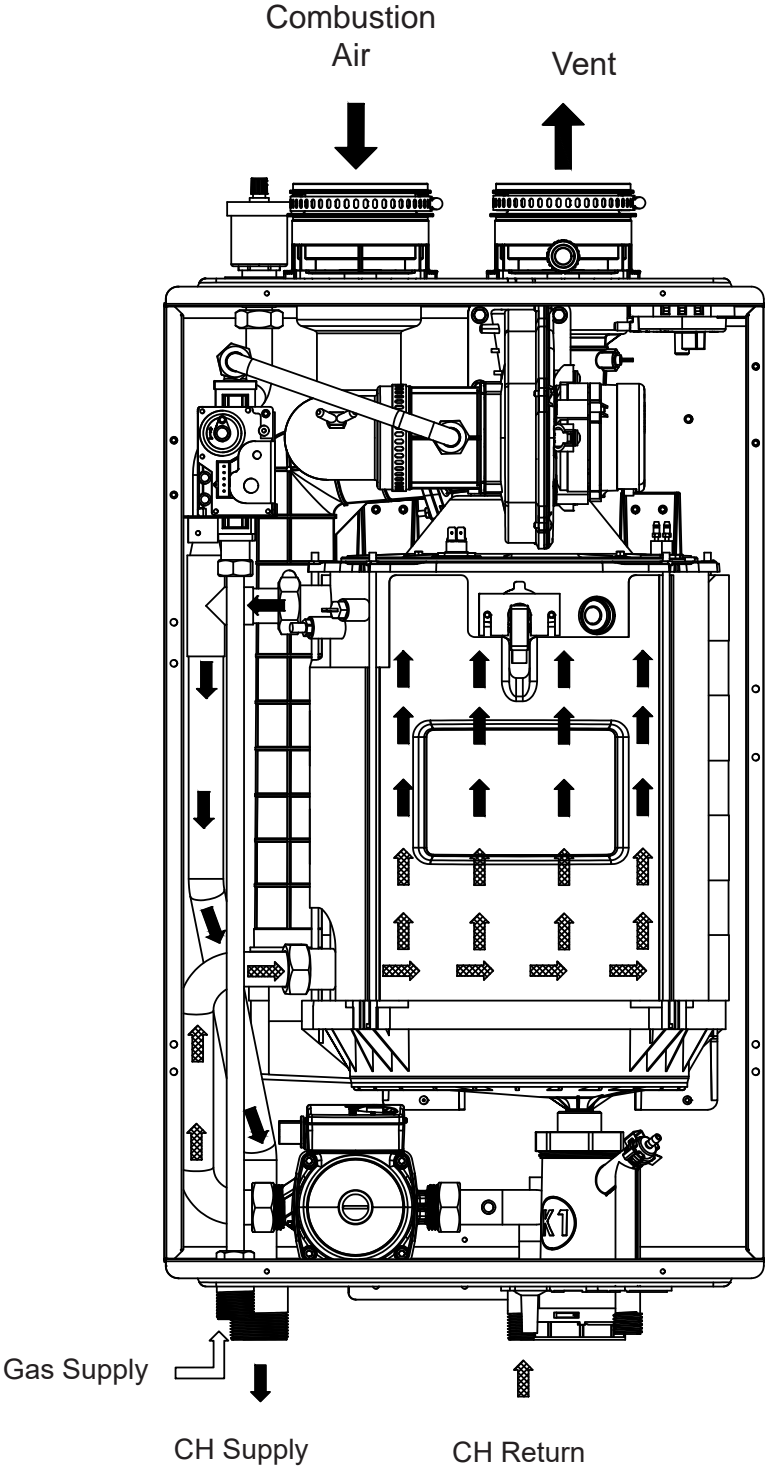


NO	Name of Component
1	Air Vent (air eliminator)
2	Air Intake Collar
3	Gas Valve
4	Gas Inlet Pipe 2
5	Air / Gas Mixing Pipe
6	Gas Inlet Pipe 1
7	Exhaust Duct
8	Overheat Temperature Sensor
9	Low Water Cut Off
10	Main PCB
11	Flame Detecting Sensor
12	Control Display
13	Manual ON/OFF Power Switch
14	'CH' Internal Pump
15	Gas Inlet Adapter
16	'CH' Supply Adapter

NO	Name of Component
17	CH Pressure Gauge
18	'CH' Return Adapter
19	Condensate Adapter
20	Condensate Trap
21	CH Return Temperature Sensor
22	Condensate Air Pressure Switch
23	Terminal Block
24	Heat Exchanger
25	Ignition Transformer
26	Sight Glass
27	Burner Overheat Switch
28	Igniter
29	BLDC Fan (blower)
30	Exhaust Temperature Sensor
31	Air Pressure Sensor
32	Vent Pipe Collar

2.5 Product Flow Paths and Characteristics

Water in the heating pipe is used for space heating.



CH = Central Heat

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.

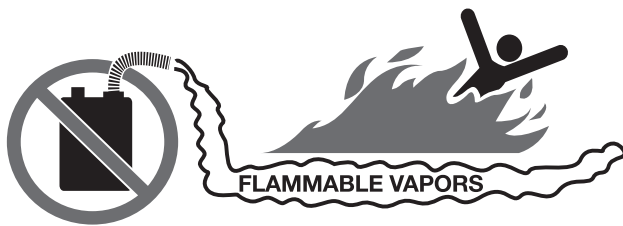
- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and 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 will explode and catch on fire. These will cause death or severe burns.
Do not use or store flammable products such as gasoline, solvents or adhesives in the same room or area near the appliance.

Keep flammable products

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

Vapors

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

Do not install the appliance where flammable products will be stored.
Read and follow boiler warnings and instructions thoroughly. If owner’s manual is missing, contact the retailer or manufacturer.

- This boiler must be installed by a qualified plumber, a licensed gas fitter, and/or a professional service technician.
Improper installation and/or operation will cause a potentially hazardous situation, such as serious injury or death. Also, it will void the warranty.
 - The National Fuel Gas Code NFPA 54 / ANSI Z224.1
 - National Electric Code ANSI/NEPA 70
 - All applicable local, state, national and provincial codes, regulations and laws.
- Proper care is your responsibility. Carefully read and understand the Operating Information in this manual before operating the Manufacturer 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.

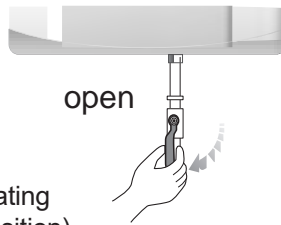
- DO NOT use this Boiler if any part has been under water. Immediately call a qualified technician for inspecting the Boiler and replacing any part of the control system and gas control which have been under water.
- Do not power up the unit until the gas and water supply valves are fully opened. Make 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 (41) and an air pressure sensor (44).

If the error code ‘41’ or ‘44’ occurs, follow the instructions below.
 - First, turn off the manual gas valve.
 - Make sure that there is no foreign object in the vent passage or rodent screen.
 - If you do not find any problem, do the following.
 - Turn off the error state by pressing the power button of Control Display.
 - 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.

WARNING

Do not use the appliance for any other purpose than for space heating and hot water heating using an indirect fired tank.

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.

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.

CAUTION

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

Carbon monoxide poisoning

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

Gas leakage test.

Gas supply line must be inspected regularly.

Do not shut off the Boiler.

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

CAUTION

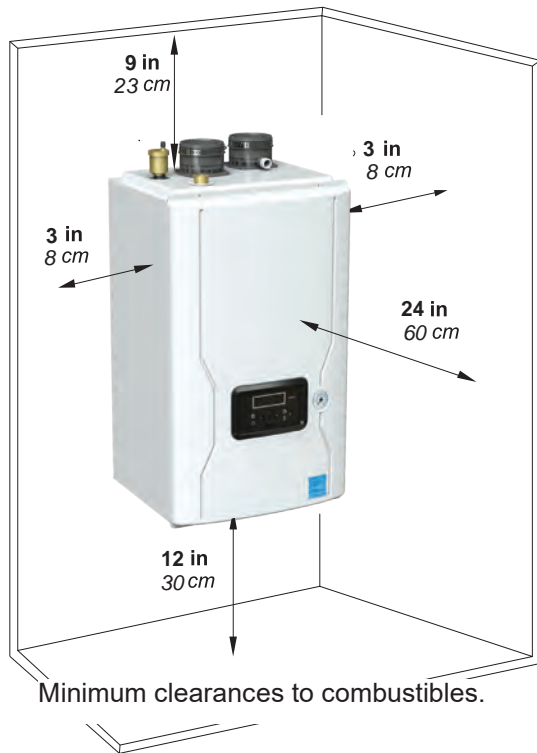
After repair of gas pipeline or gas regulator replacement, call a qualified contractor for inspection before starting it up.

SECTION 4 Installation

NOTE: For Cascading Installations, please refer to document 1349 'Cascading the FT Series Boiler', available online.

4.1 Location and Clearances

The FT must be mounted to a suitable wall by a qualified heating contractor under the guidelines of a boiler. The wall may be of concrete or wood. Suitable fasteners for concrete or wood must be used. Failure to wall mount this boiler using correct fasteners will affect the performance and life expectancy of the boiler and will void the warranty.



Appliance Surface	Clearance from Combustibles and Non-combustible Surfaces	Suggested Service Clearance
TOP	9 in (23 cm)	18 in (46 cm)
BACK	0 in (0 cm)	0 in (0 cm)
FRONT	24 in (61 cm)	40 in (101 cm)
SIDE	3 in (7 cm)	8 in (20 cm)
BOTTOM	12 in (30 cm)	24 in (61 cm)

Table 1. Minimum Clearances to Combustibles and for Service.

WARNING

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

WARNING

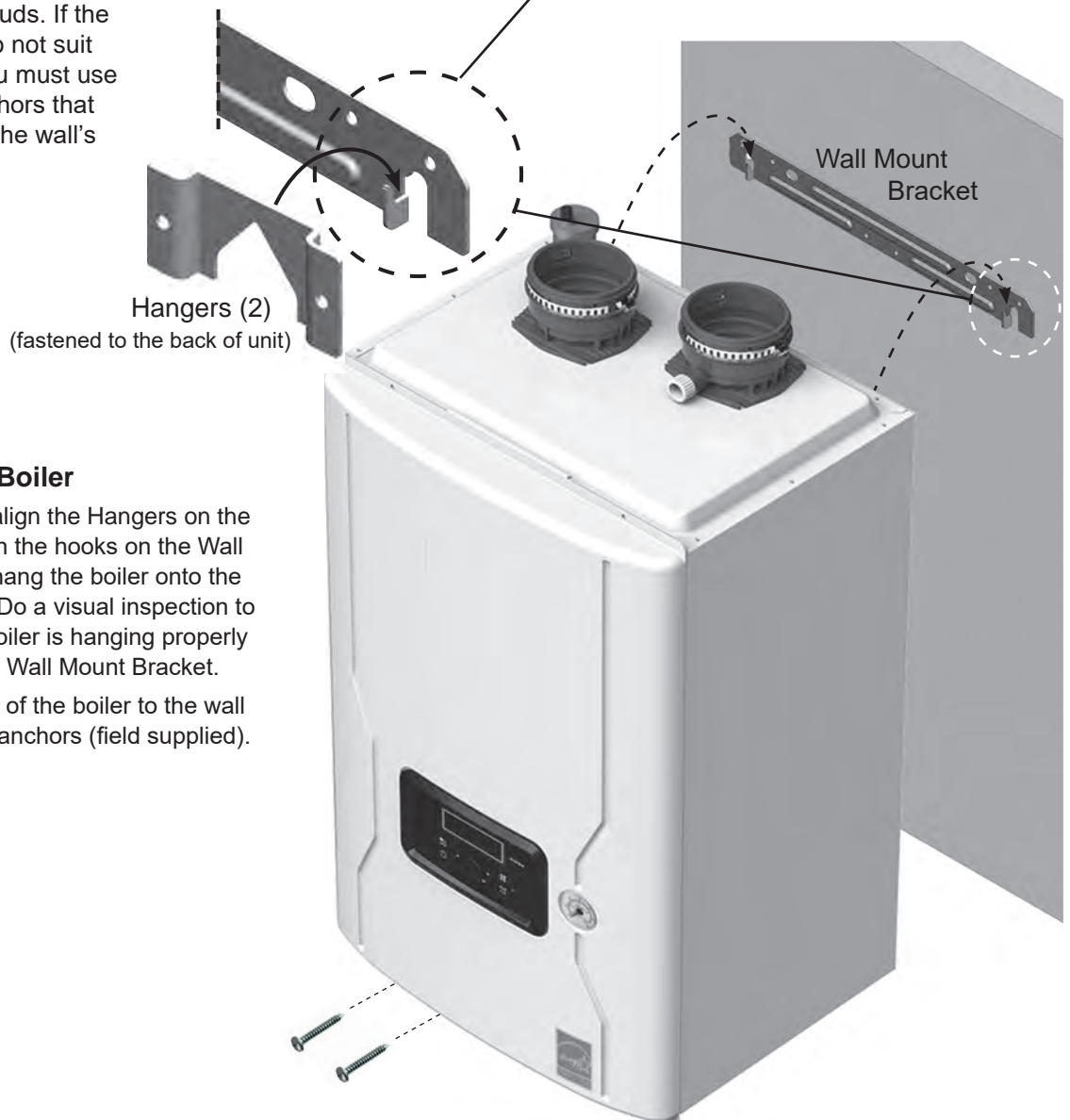
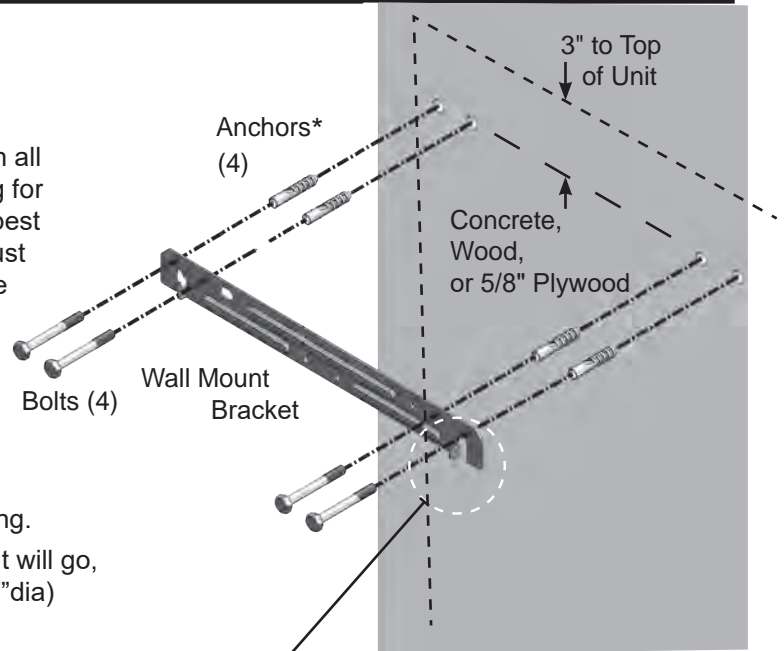
- CLEARANCES FOR SERVICE ACCESS
 - If you do not provide the minimum clearances shown, it might not be possible to service the boiler without removing it from the space.
 - Space must be provided with combustion / ventilation air openings correctly sized for all other appliances located in the same space 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.

4.2 Wall Mount Bracket

4.2.1 The installation height and location

for your FT depends on your installation scenario. With all clearances considered, and given adequate positioning for air supply and venting, you will need to determine the best position to mount the Wall Mount Bracket. The wall must be concrete, wood, or plywood over studs, and must be strong enough to hold the boiler!

- Start by familiarizing yourself to how the included Wall Mount Bracket hooks underneath the two Hangers that are attached to the back of the boiler. The 'hooks' of the Wall Mount Bracket will be 3" from the Top of the boiler once the boiler is hung.
- Position the Wall Mount Bracket at the location that it will go, being sure that it is level, and then drill 4 holes (0.47" dia) with a 1/2" drill bit, into the wall through the Bracket.
- If mounting to a concrete wall, then use the concrete anchors. If onto wood or 5/8" (16 mm) plywood, then use the wood screws. Do not hang the FT onto sheetrock unless it is possible to fasten directly into the structural studs. If the included anchors do not suit your installation, you must use 'Field Supplied' anchors that are appropriate for the wall's construction.



4.2.2 Hang the Boiler

- Lift the boiler up, align the Hangers on the back of the boiler with the hooks on the Wall Mount Bracket, and hang the boiler onto the Wall Mount Bracket. Do a visual inspection to make sure that the boiler is hanging properly onto the hooks of the Wall Mount Bracket.
- Fasten the bottom of the boiler to the wall using 2 suitable wall anchors (field supplied).

4.3 Combustion Air

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

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

4.3.1 Combustion Air from Room

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

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

Method 2: One permanent opening, commencing within 12" (300mm) of the top of the enclosure, shall be permitted. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that directly communicate with the outdoors and shall have a minimum free area of 1 square inch per 3000 Btu/hr (734 square mm/kW) of the total input rating of all equipment located in the enclosure. This opening must not be less than the sum of the areas of all vent connectors in the confined space.

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

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

4.3.2 Ducted Combustion Air

The combustion air can be taken through the wall, or through the roof. When taken from the wall, it must be taken from out-of-doors by means of the Manufacturer 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 an upward slope away from the boiler of at least ¼ inch per foot (21 mm/m) to prevent accumulation of condensate; and For Category II and IV boilers, where necessary, have means provided for drainage of condensate.

⚠ NOTICE

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

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

⚠ CAUTION

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

⚠ AVIS

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

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

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

⚠ CAUTION

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

4.4 Venting, Exhaust

⚠ NOTICE

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

⚠ NOTICE

For Cascading Installations, please refer to document 1349 'Cascading the FT Series Boiler', available online.

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.

⚠ AVIS

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

⚠ WARNING

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

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

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

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

IN CANADA all venting used must meet the following requirements:

1. ULC-S636 certified and marked
2. The first 3 feet of venting must be accessible for visual inspection.

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.

4.4 Venting, Exhaust (continued)

3. **All components used in the vent system must be from a certified manufacturer.**
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 boiler as directly as possible. Seal all joints and provide adequate hangers as required in the venting system manufacturer's Installation Instructions. Horizontal portions of the venting system must be supported to prevent sagging and may not have any low sections that could trap condensate. The unit must not support the weight of the vent pipe.

WARNING

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

4.5 General Location Guideline

1. Vent system installation must be in accordance with Local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z224.1 /NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.
2. The Boiler is designed to be installed as a Direct Vent (sealed combustion) type. The air for combustion must be supplied directly from the outside to the burner. Also, the flue gases must be vented directly to the outdoors (through wall or roof).
3. Do not install venting system components on the exterior of building except as specifically required by these instructions
 - Vent terminals must be at least 1 foot from any door, window, or gravity inlet into the building.
 - Maintain the correct clearance and orientation between the vent and air intake terminals. The vent and air intake terminals must be at the same height and their center lines must be spaced apart 12" minimum.
 - The bottom of the vent and air intake terminal must be at least 12" above the normal snow line. In no

case should they be less than 12" above grade level.

- Do not install the vent terminal directly over windows or doors.
- Air intake terminal must not terminate in areas that might contain combustion air contaminants, such as near swimming pools.
- For sidewall venting, the minimum horizontal distance between any adjacent individual Module (Boiler) vent terminations is twelve (12) inches. It is better to be far more than 12 inches for avoiding frost damage to building surfaces where vent terminations are placed.
- The minimum horizontal distance between any adjacent individual module (boiler) roof vent end piece is one (1) foot.

The vent shall not terminate:

- over public walkways:
- near soffit vents, crawl space vents or other areas where condensate or vapor could create a nuisance or hazard, or cause property damage: or
- where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves or other equipment.

4.6 Locations for Vent Pipe Terminator

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

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

Notes:

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

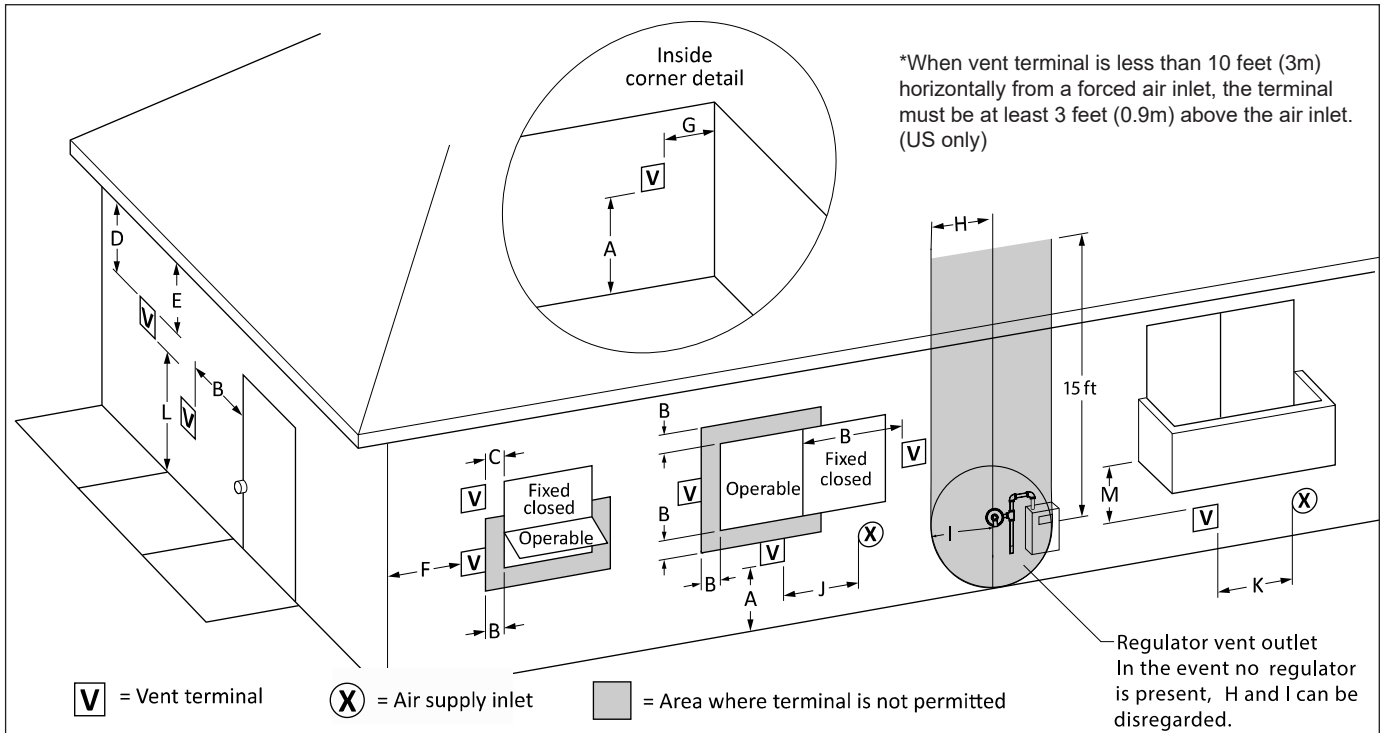


Table 4. Direct Vent Clearances

4.6.1 Venting Requirements in the Commonwealth of Massachusetts

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

1. Installation of Carbon Monoxide Detectors

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

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

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

2. Approved Carbon Monoxide Detectors

Each carbon monoxide detector shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

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

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

⚠ 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.

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

4.7 Air Supply and Vent Connections

4.7.1 Vent / Air Pipe Lengths

	2" Combustion Air & Vent Pipe			3" Combustion Air & Vent Pipe		
	Min. Combustion Air Pipe	Min. Vent Pipe	Max. Combustion Air & Vent Pipe	Min. Combustion Air Pipe	Min. Vent Pipe	Max. Combustion Air & Vent Pipe
MFTHW 100/140/199 NG & LP	0 FT* (0 M)	3 FT (1 M)	50 FT (15 M)	0 FT* (0 M)	3 FT (1 M)	100 FT (30 M)
Deductions per 90° Elbow	8 FT (2.4 M)			5 FT (1.5 M)		
Deductions per 45° Elbow	4 FT (1.2 M)			2.5 FT (.75 M)		
Max. # of Total Elbows on Air Intake & Exhaust Vent	4			6		

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

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

NOTES:

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

Example: 2" venting system desired.

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

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

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

4.7.2 Direct Venting

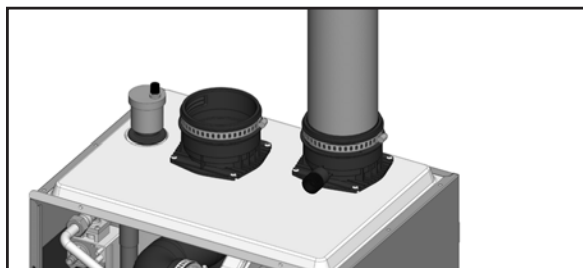
The FT boiler can use 3" or 2" diameter exhaust and 3" or 2" diameter intake air ducts. To ensure the draw of air directly from and exhaust of air directly to the outside of the building, create an airtight seal from the boiler collar to the vent termination.

(For installations in Canada) field-supplied plastic vent piping must comply with CAN/CSA B149.1 (latest edition) and be certified by the Standard For Type BH Gas Venting Systems, ULC-S636. Components of this listed system must not be interchanged with other vent systems or unlisted pipes or fittings. All plastic components and specified primers and glues of the certified vent system must be from a single system manufacturer and must not be intermixed with another system manufacturer's parts.

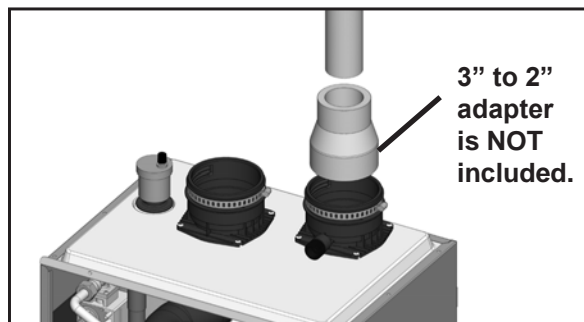
■ Tightening — Boiler Collar (Socket) to Vent Pipe & Inlet Pipe

- Clean and dry your selected PVC, CPVC vent pipe and Manufacturer 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 a field supplied 3" to 2" adaptor. Adaptor must be installed in vertical section of piping only.

3" pipe



2" pipe connected, using an adapter

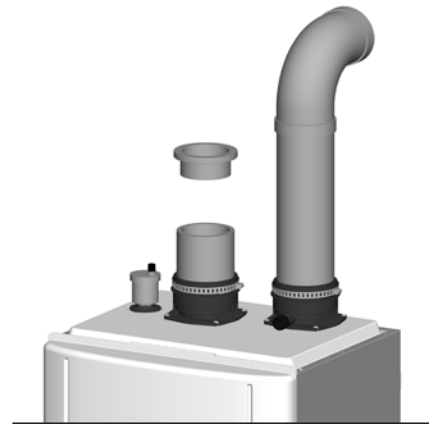


4.7.3 Indoor Combustion Air

Read and Follow Sections 4.3 Guidelines First.

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

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



Model	FTHW100	FTHW140	FTHW199
Maximum Input (BTU/H)	100,000	140,000	199,000
Indoor make up air is provided, a minimum free area of 1 in ² per 1,000 BTU/H	100 in ² 13 1/4" (W) x 13 1/4" (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)

Table 6. Adequate Free Area

4.8 Vent / Air Pipe Termination

All Terminations:

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

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

2" Vent Screen P/N - FT1508

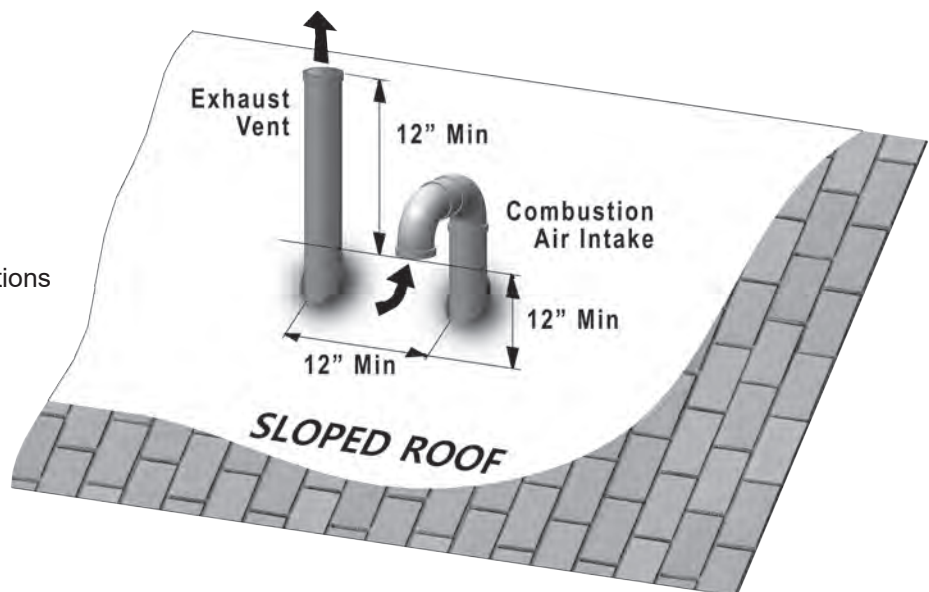
3" Vent Screen P/N - FT1730

Vertical Vent Termination

- Direct Vent - Vertical Terminations with Sloped Roof

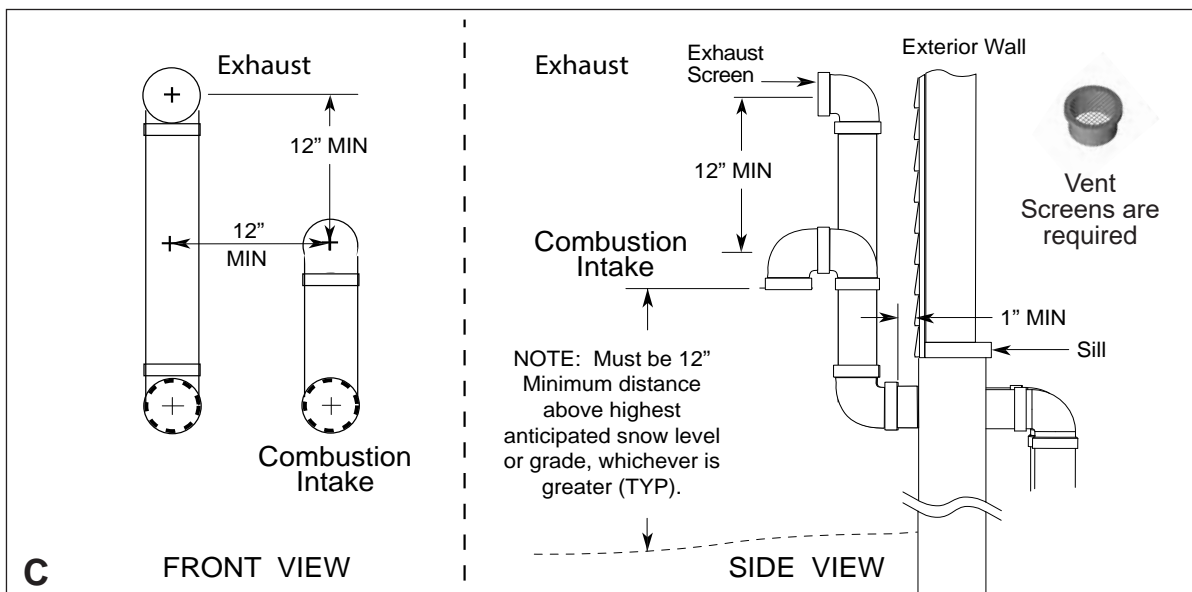
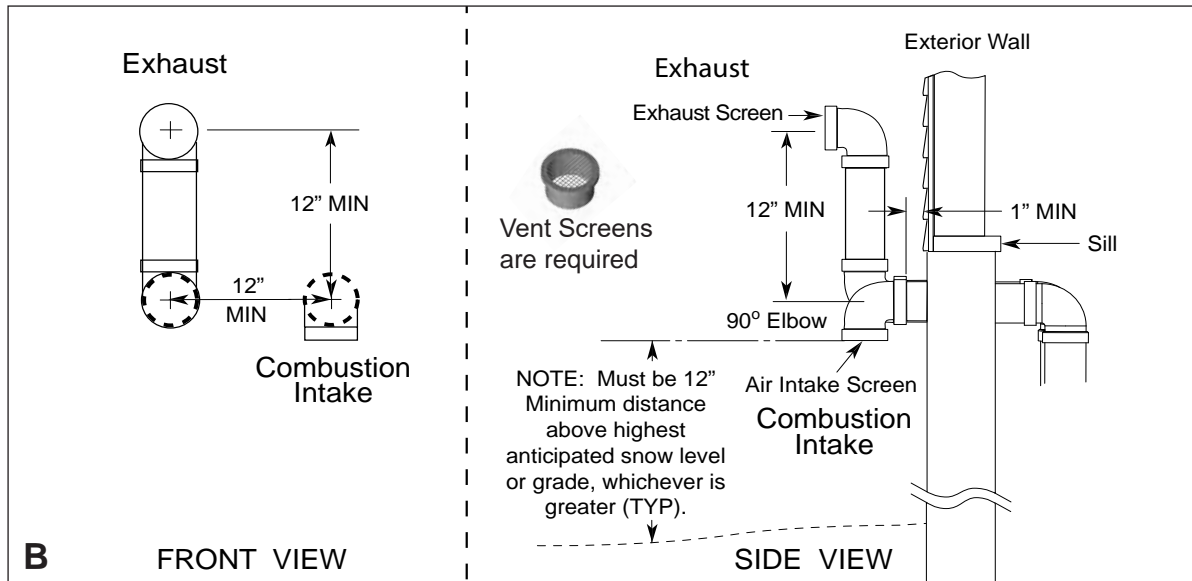
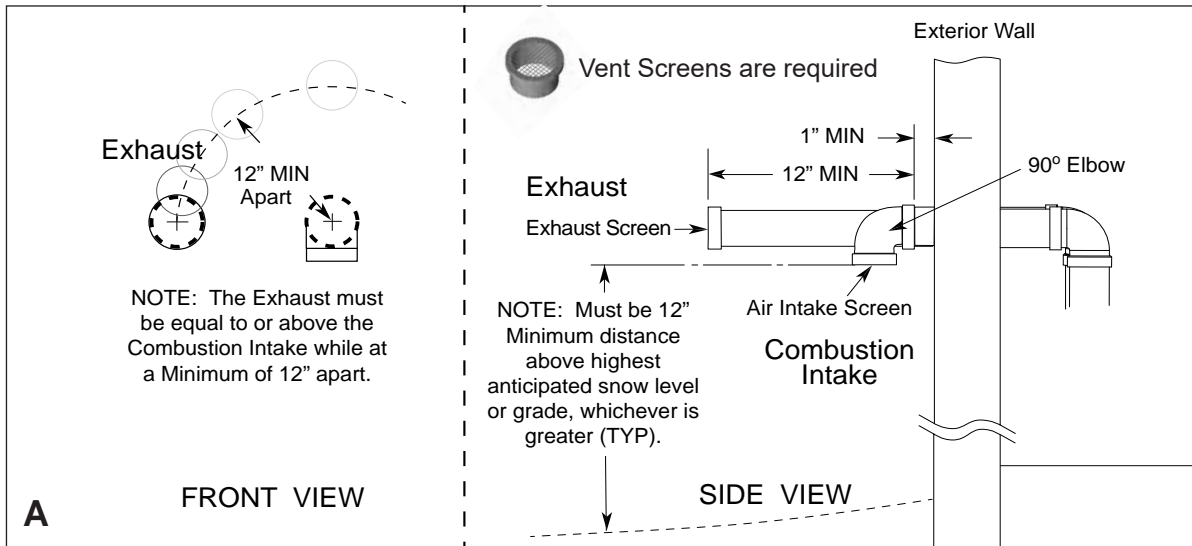


Vent Screens are required



4.8 Vent / Air Pipe Termination (continued)

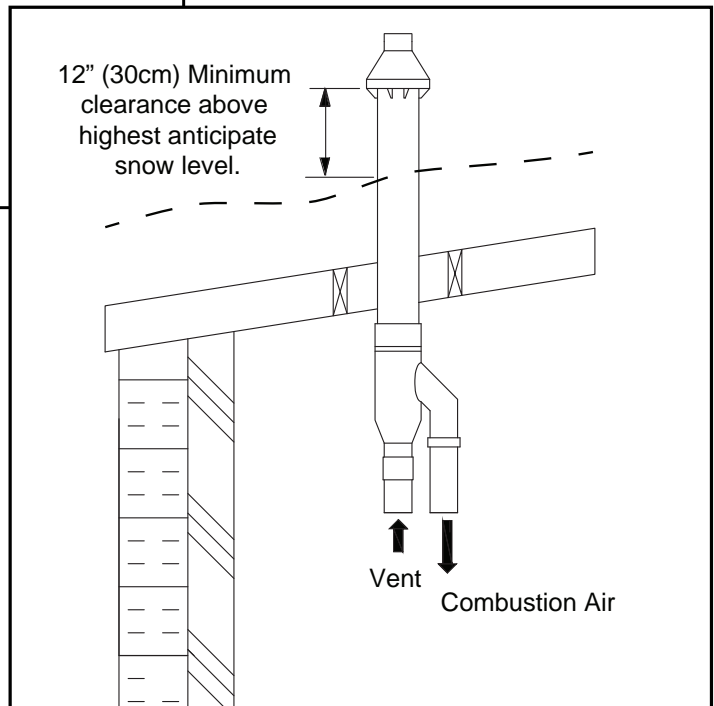
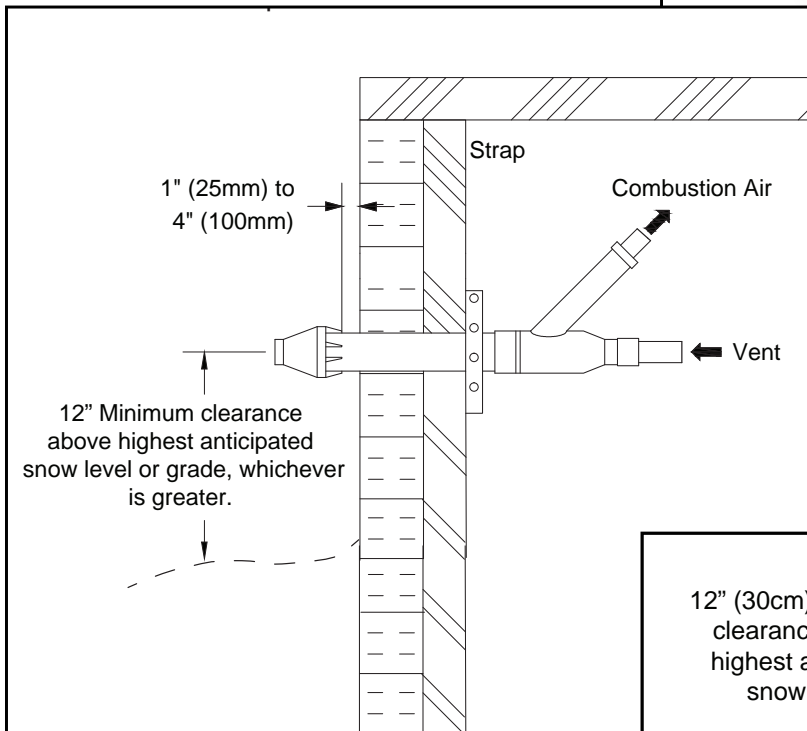
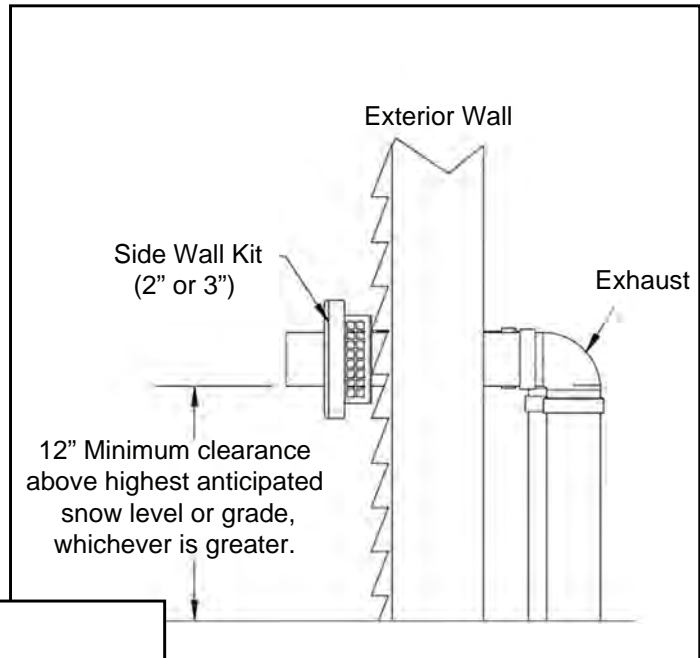
Horizontal Vent Termination • Direct Vent - Sidewall Termination



Concentric Vent Termination

- Direct Vent - Optional Horizontal and Vertical Concentric Vent

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



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 7, Table 8 and Table 9 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 greater than 1/2 PSIG (3.45kPa).
10. The appliance and its gas connection must be leak tested before placing it in operation.
11. Purge all air from gas lines.

CAUTION

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

ATTENTION

PRV (inclus) doit être installé immédiatement en la chaudière sortie, 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.

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

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

Table 7. 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 8. 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 9. Equivalent Pipe Lengths

Natural Gas Pipe Sizing (Maximum)

Maximum capacity of pipe in cubic feet of gas per hour for gas pressures of 0.5psi or less and a pressure drop of 0.5 Inch water column. (Based of a 0.60 Specific gravity gas)

- For reference only. Referenced from gas pipe manufacturer specifications for actual delivery capacity. The DOE standard for Natural Gas is 1100 BTU/ft³. Contact the local gas supplier for actual BTU/ft³ rating.

Pipe size	Length (ft)									
	10	20	30	40	50	60	80	100	150	200
1/2"	82	58	47	41	37	37	29	26	20	18
3/4"	192	137	112	97	87	80	69	62	48	44
1"	383	269	218	188	168	153	132	118	91	82
1-1/4"	639	456	374	325	292	267	232	208	171	148
1-1/2"	1260	888	723	625	559	509	440	393	320	277
2"	2930	2080	1700	1470	1320	1200	1040	933	762	661

Table 10. Length of Corrugated Stainless Steel Pipe.

(Refer to the ANSI Z223.1 NATIONAL FUEL GAS CODE 2012 EDITION)

Pipe size	Length (ft)									
	10	20	30	40	50	60	80	100	150	200
1/2"	172	118	95	81	72	65	56	50	40	34
3/4"	360	247	199	170	151	137	117	104	83	71
1"	678	466	374	320	284	257	220	195	157	134
1-1/4"	1390	957	768	657	583	528	452	400	322	275
1-1/2"	2090	1430	1150	985	873	791	677	600	482	412
2"	4020	2760	2220	1900	1680	1520	1300	1160	928	794

Table 11. Length of Black Iron Pipe (Schedule 40 Metallic)

(Refer to the ANSI Z223.1 NATIONAL FUEL GAS CODE 2012 EDITION)

4.9 Gas Supply and Piping (continued)

■ Propane Gas Pipe Sizing (Maximum)

Intended use : Pipe Sizing Between Single-or Second-Stage (Low Pressure) Regulator and Appliance.

- For reference only. Referenced from gas pipe manufacturer specifications for actual delivery capacity. The DOE standard for Natural Gas is 1100 BTU/ft³. Contact the local gas supplier for actual BTU/ft³ rating.

Inlet Pressure : 11 in. w.c / Pressure Drop : 0.5in. w.c / Specific Gravity : 1.5

Pipe size	Length (ft)									
	10	20	30	40	50	60	80	100	150	200
1/2"	129	91	74	64	58	53	45	41	31	28
3/4"	303	216	177	153	137	126	109	98	75	69
1"	605	425	344	297	265	241	208	186	143	129
1-1/4"	971	661	528	449	397	359	307	270	217	183
1-1/2"	1990	1400	1140	988	884	805	696	621	506	438
2"	4640	3290	2680	2330	2080	1900	1650	1480	1210	1050

Table 12. Length of Corrugated Stainless Steel Pipe.

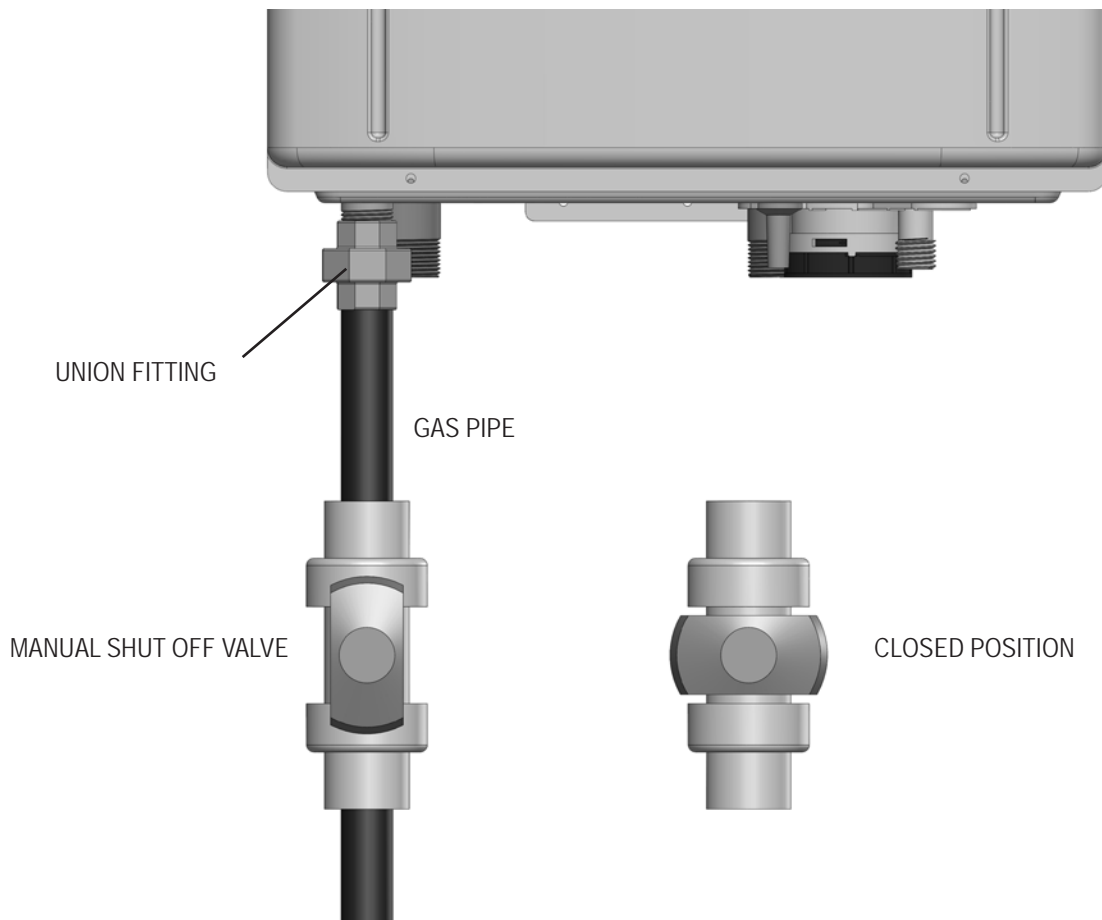
(Refer to the ANSI Z223.1 NATIONAL FUEL GAS CODE 2012 EDITION)

Pipe size	Length (ft)									
	10	20	30	40	50	60	80	100	150	200
1/2"	291	200	160	137	122	110	101	94	84	67
3/4"	608	418	336	287	255	231	212	197	175	140
1"	1150	787	632	541	480	434	400	372	330	265
1-1/4"	2350	1620	1300	1110	985	892	821	763	677	543
1-1/2"	3520	2420	1940	1660	1480	1340	1230	1140	1010	814
2"	6790	4660	3750	3210	2840	2570	2370	2200	1950	1570

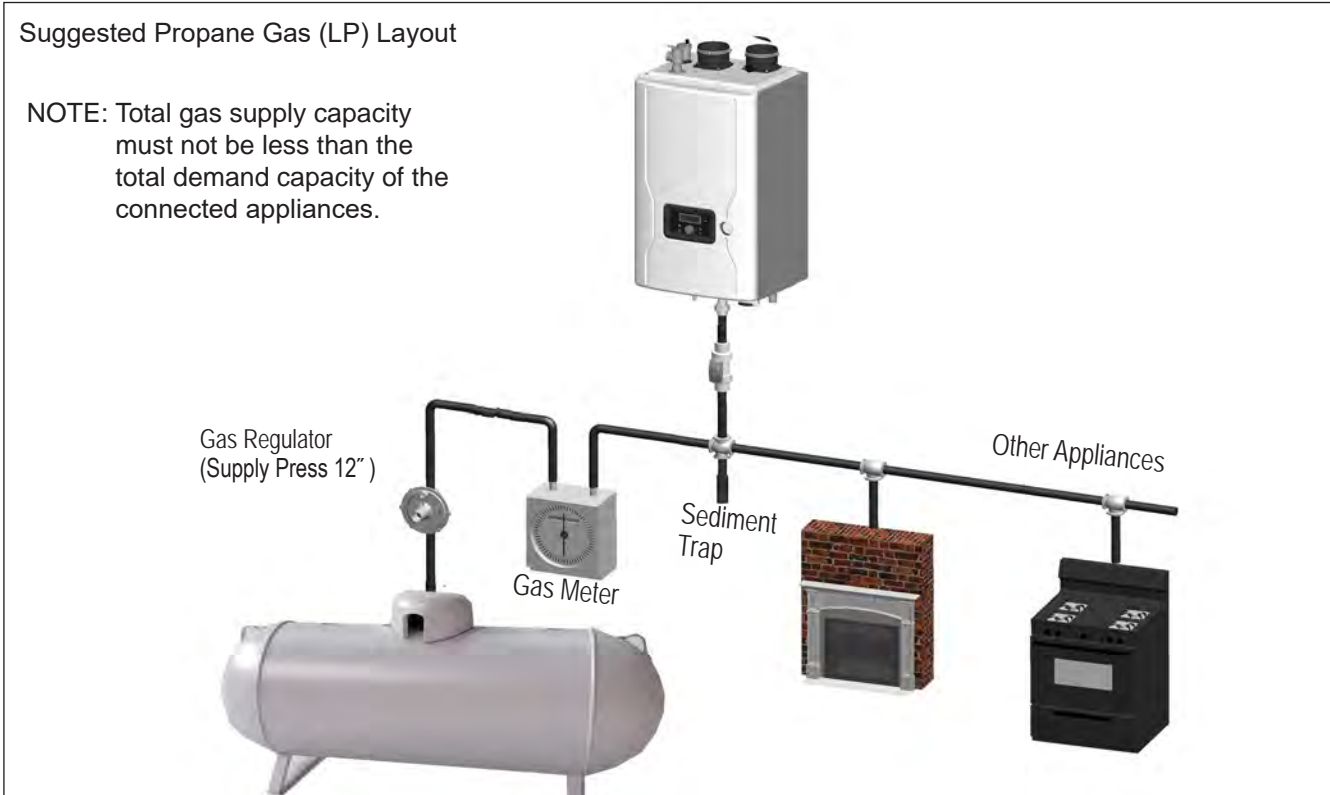
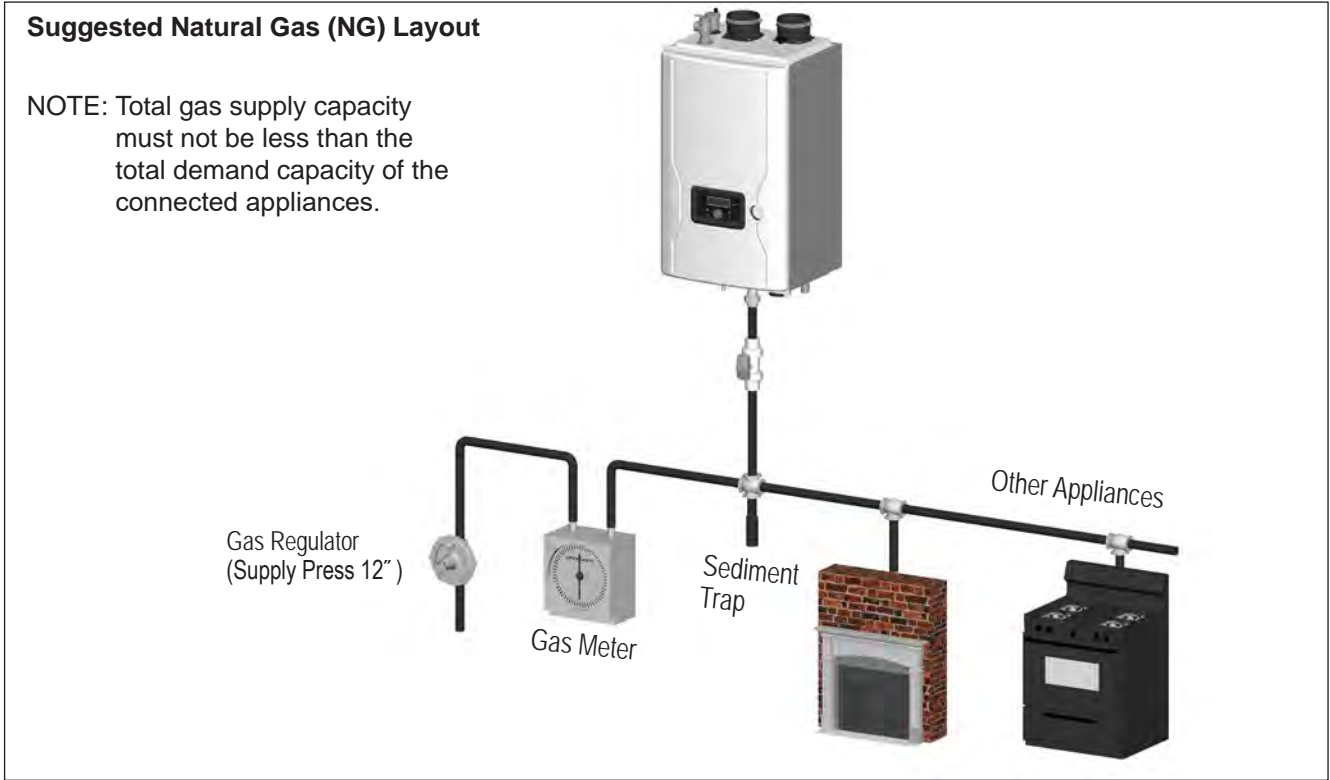
Table 13. Length of Black Iron Pipe (Schedule 40 Metallic)

(Refer to the ANSI Z223.1 NATIONAL FUEL GAS CODE 2012 EDITION)

- The gas connection fitting on the unit is 3/4" male NPT.
 - The supply line must be sized for the maximum output of the 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 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 Boiler.
 - 1) Install an approved gas line pipe to gas line connection under the 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 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 boiler until all connections have been completed, checked for leaks, and the heat exchanger is filled with water.



4.9 Gas Supply and Piping (continued)



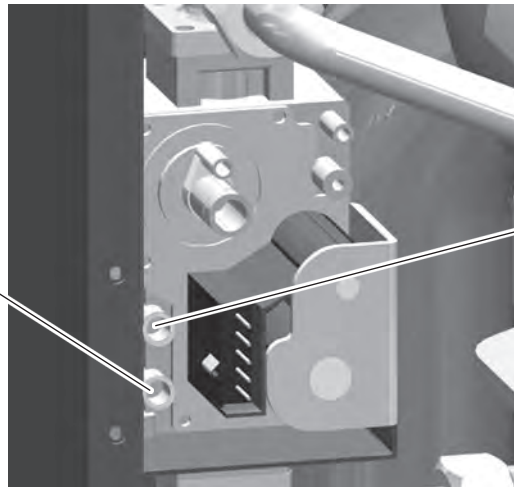
- Boiler must be installed downstream of the gas meter for adequate gas supply.
- Boiler gas connection pipe not less than a 1/2".

4.10 Gas Supply Pressure

■ The minimum and maximum inlet gas line pressures must be

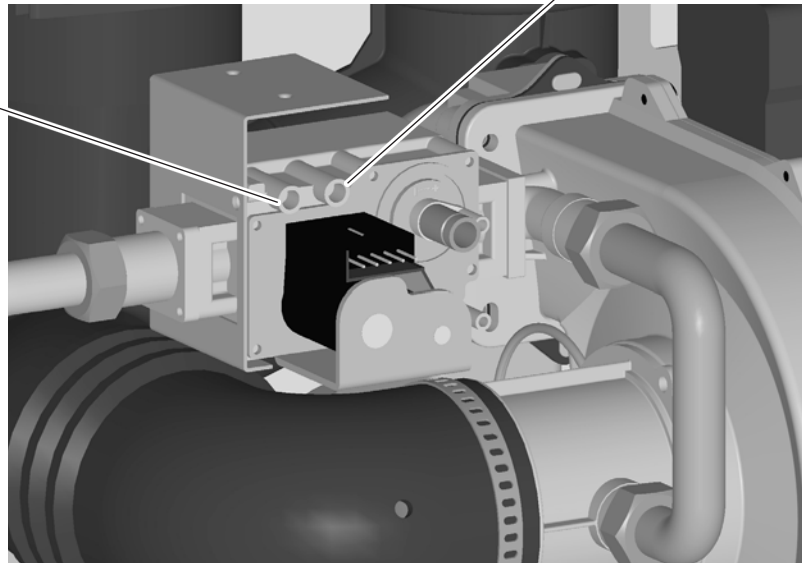
Natural Gas		LP Gas	
Maximum Pressure	10.5" WC	Maximum Pressure	13.0" WC
Minimum Pressure	3.5" WC	Minimum Pressure	8.0" WC

Gas Valve
100 - 140 MBH
Inlet Gas Pressure Port



Manifold Pressure Port

Gas Valve
199 MBH
Inlet Gas Pressure Port



Manifold Pressure Port

⚠ CAUTION

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

4.11 Gas Setup and Adjustment

For the Step by step process to measure CO₂ values on the FT, please refer to Steps 12 thru Step 22 in Section 4.13 of this Installation Manual.

WARNING

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

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

CO ₂ value		Propane Gas (LP)		Natural Gas (NG)	
		2" VENT	3" VENT	2" VENT	3" VENT
All sizes and all altitudes	Max fire	9.5~11%		8.5~10.5%	
	Min fire	9~10.5 %		8~10%	

Table 14. CO₂ Values

Manifold pressure		Propane Gas (LP)	Natural Gas (NG)
FTHW 100	Max fire	-0.075" WC	-0.070" WC
	Min fire	-0.003" WC	-0.000" WC
FTHW 140	Max fire	-0.130" WC	-0.100" WC
	Min fire	-0.004" WC	-0.002" WC
FTHW 199	Max fire	-0.169" WC	-0.129" WC
	Min fire	-0.015" WC	-0.015" WC



NOTE: Values in Table 15 in the range of -.001 to -.35 Inches WC are indicative of proper set-up. If your readings are outside this range, please call technical support.

Table 15. Manifold Pressures


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

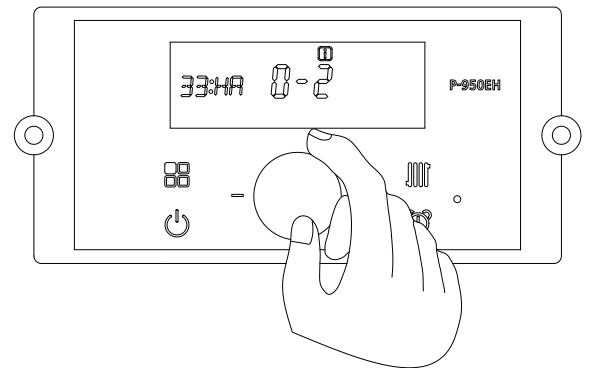
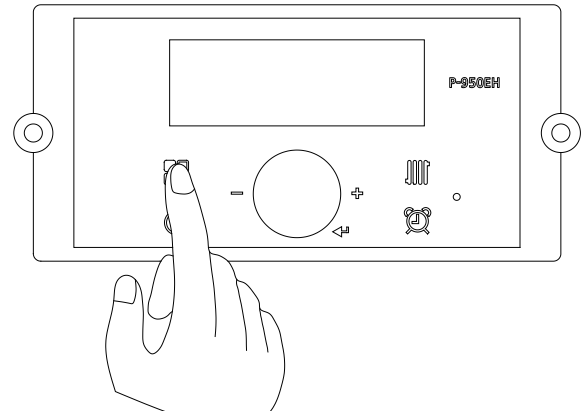
The FT is shipped with a default factory setting for installation at an altitude of 0 to 2000' (approx). For maximum efficiencies at higher altitudes (2,000' to 10,000'), the FT does have an adjustment in the Installer Parameters Mode.

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.
2. Turn the dial (E) until '**33:HA**' appears.
3. Press the dial (E).
4. Set the high altitude value by turning the dial.
Refer to table.

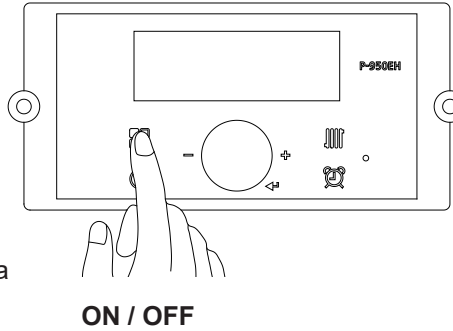
#	Altitude of Installation
0	0~1999 ft (0~609 m)
1	2,000~4,499 ft (610~1,645 m)
2	4,500~7,699 ft (1,646~2,346 m)
4	7,700~10,000 ft (2,347~3,048 m)

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, heating only, 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 gas conversion kit.



NOTICE

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

CAUTION

This boiler has been assembled at the factory to burn natural gas, but can be converted to burn LP gas. Be sure to confirm that the gas at this installation is propane gas (LP), before performing this conversion, and then placing the boiler into operation.

Steps 1 thru 24

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.)

Model	Nat Gas (NG) Part #	Propane (LP) Part #
FTHW 100	FT2056	FT2057
FTHW 140	FT2027	FT2028
FTHW 199	FT1780	FT1802



Table A. Gas Conversion Parts

WARNING

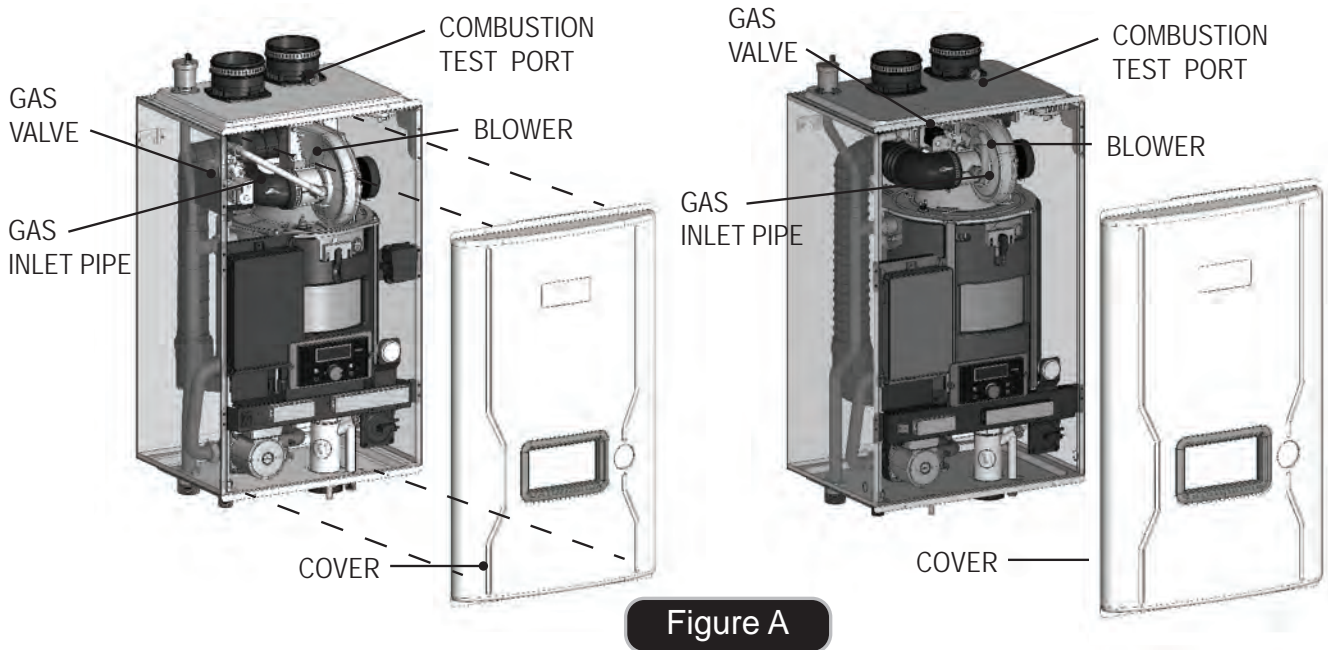
This conversion shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, an explosion or production of carbon 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. Installation must conform to local codes and the latest edition of the National Fuel Gas Code, ANSI Z223.1 and CAN-B149.1. Failure to follow instructions could result in serious injury or property damage. The qualified agency performing this work assumes responsibility for gas conversion.



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. L'installation doit être conforme aux codes locaux et la dernière édition du National Code de gaz combustible, ANSI Z223.1 et peut-B149.1. Non-respect des instructions peut entraîner des blessures graves ou des dommages matériels. L'organisme qualifié effectuant ce travail suppose la responsabilité de conversion au gaz.

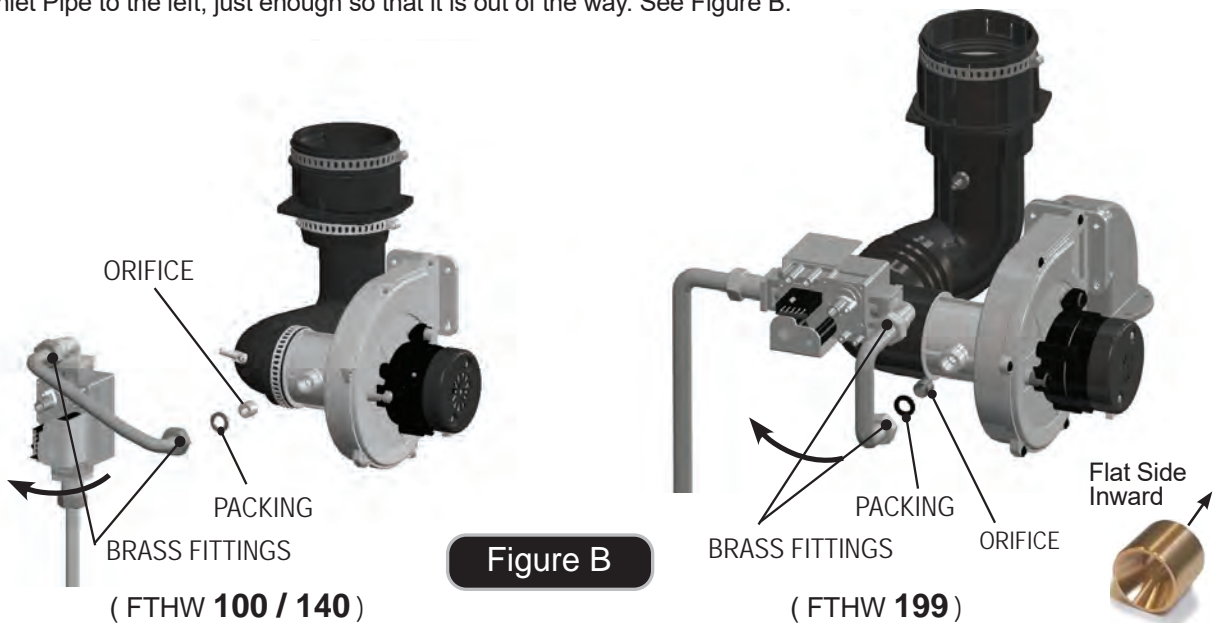
- Using a Phillips screwdriver, remove the 4 screws on the front cover. See Figure A.



(FTHW 100 / 140)

(FTHW 199)

- Locate the Gas Inlet Pipe at the top of the unit as is shown in Figure A, and loosen the Brass Fittings at both ends of the Gas Inlet Pipe.
- Completely un-thread the Brass Fittings at the blower end of the Gas Inlet Pipe, and then carefully swing the Gas Inlet Pipe to the left, just enough so that it is out of the way. See Figure B.



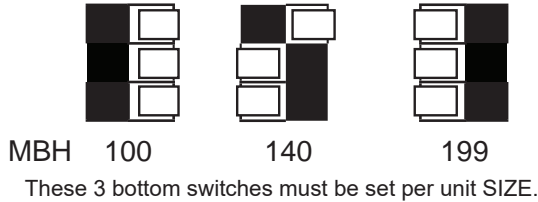
(FTHW 100 / 140)

(FTHW 199)

- Remove the existing Natural Gas Orifice. Save the Packing for re-use. It is also advised to save the orifice just in case the unit needs to be converted back to natural gas at any time in the future.
- Replace the old Orifice with the new one for LP (propane). Re-use the Packing from previous.
- Return the Gas Inlet Pipe to its original position and tighten both of the Brass Fittings.

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



These 3 bottom switches must be set per unit SIZE.



Shown is a **Model 140** with 3" Venting and using Natural Gas

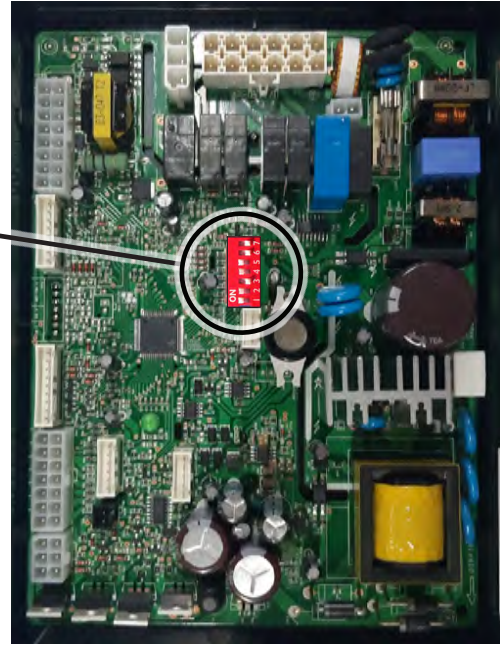
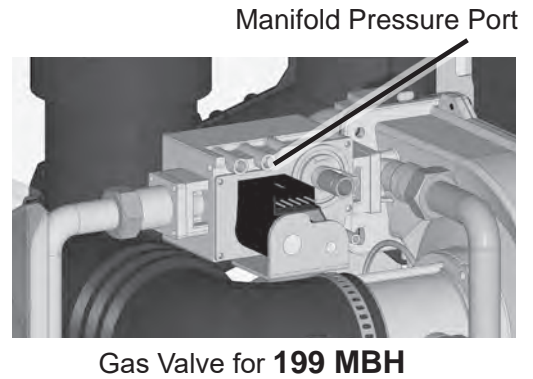
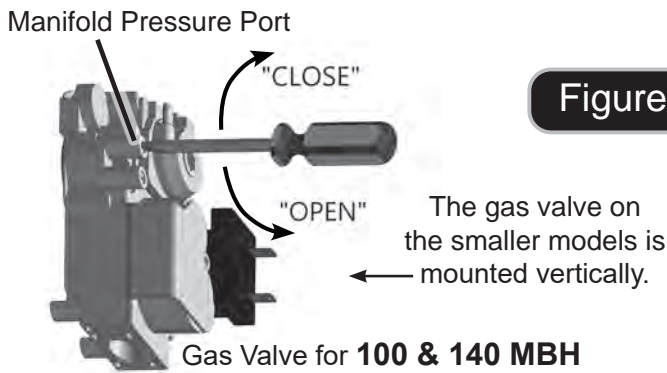


Table B DIP Switch Settings

9. Per **Table B**, set DIP Switch **5** to **OFF** for LP Propane.
10. Turn **ON** the GAS and WATER supply to the FT.
11. Turn **ON** the FT.
12. Connect a manometer to the manifold pressure port. For dual port manometers, use the positive pressure side. Check for proper manifold gas pressure. Refer to Table C.



Manifold pressure		Propane Gas (LP)	Natural Gas (NG)
FTHW 100	Max fire	-0.075" WC	-0.070" WC
	Min fire	-0.003" WC	-0.000" WC
FTHW 140	Max fire	-0.130" WC	-0.100" WC
	Min fire	-0.004" WC	-0.002" WC
FTHW 199	Max fire	-0.169" WC	-0.129" WC
	Min fire	-0.015" WC	-0.015" WC

Table C

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

13. Establish a call for heat. You may need to disconnect the outdoor reset if you are making this gas conversion during warm weather.

CO ₂ value		Propane Gas (LP)		Natural Gas (NG)	
		2" VENT	3" VENT	2" VENT	3" VENT
All sizes (and all altitudes)	Max fire	9.5~11%		8.5~10.5%	
	Min fire	9~10.5 %		8~10%	

Table D

14. Setup your combustion analyzer and place the sensor into the combustion test port
15. Per **Table B for Max Fire**, change dip switch 6 to ON and 7 to OFF. The unit will cycle up to MAX fire.
16. WAIT for your combustion analyzer to stabilize. This may take up to 3 minutes depending on your combustion analyzer. Then measure the CO₂ for MAX fire. Refer to Table D for acceptable MAX fire combustion readings Do NOT adjust CO₂ at MAX Fire. ONLY in MIN Fire, so...
17. Per **Table B for MIN Fire**, change dip switch 6 to OFF and 7 to ON. The unit will cycle down to MIN Fire.
18. WAIT for your combustion analyzer to stabilize. Then measure the CO₂ for MIN fire. Refer to Table D for acceptable MIN fire combustion readings
19. Open the Gas Valve Adjustment Port by removing the cap screw with a T15 Star/Torx screwdriver.
20. Then use the T15 Star/Torx to make a minor adjustment (1/8 turn) to either increase or decrease CO₂.
21. 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 CO₂ at both are within acceptable levels. Be sure to put the adjustment port cap screw back onto the valve when done.
22. Once the CO₂ and manifold pressure measurements for both MIN and MAX Fire are acceptable, set DIP switches 6 and 7 to the OFF position for Nominal Fire (normal operation).
23. Write in the correct conversion date and the technicians name to the included gas conversion sticker. See Figure E. Then apply that sticker adjacent to the rating plate.
24. Put the boiler cover back on and assemble/tighten the 4 screws that hold the cover in place.

This unit was converted on ___/___/___ to ___ gas
 with kit # _____ by _____
 (name and company _____
 accountable) _____

Cette unité a été converti ___/___/___ en ___ gaz
 en utilisant le kit numéro _____ par _____
 (nom et société _____
 responsable) _____

Figure E (Conversion label)

H2415900

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 CH supply and return connections are 1-1/4". The system piping must be a minimum of 1-1/4". (See Sections 4.14.4 & 4.14.5)
- Isolation valves (Shutoff valve) will be used.
- All piping should be insulated.

4.14.2 Backflow Preventer and Boiler Feed Valve

- Apply a Backflow Preventer and Boiler Feed Valve to the unit as required by local codes.

4.14.3 Diaphragm type Expansion tank

- I installation of a diaphragm expansion tank is required. Failure to install a properly sized expansion tank can cause premature failure of the boiler pressure relief valve and/or damage the boiler. Damage caused by thermal expansion is not covered under the FT product warranty.
- You should always install an 'Automatic Air Vent to remove residual air from the system.
- An Automatic air vent has been installed at the top of the boiler.

 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 : 1-1/4"

 CAUTION

For guidelines in the use of Glycol Products. Please refer to Section 8.3 on page 77

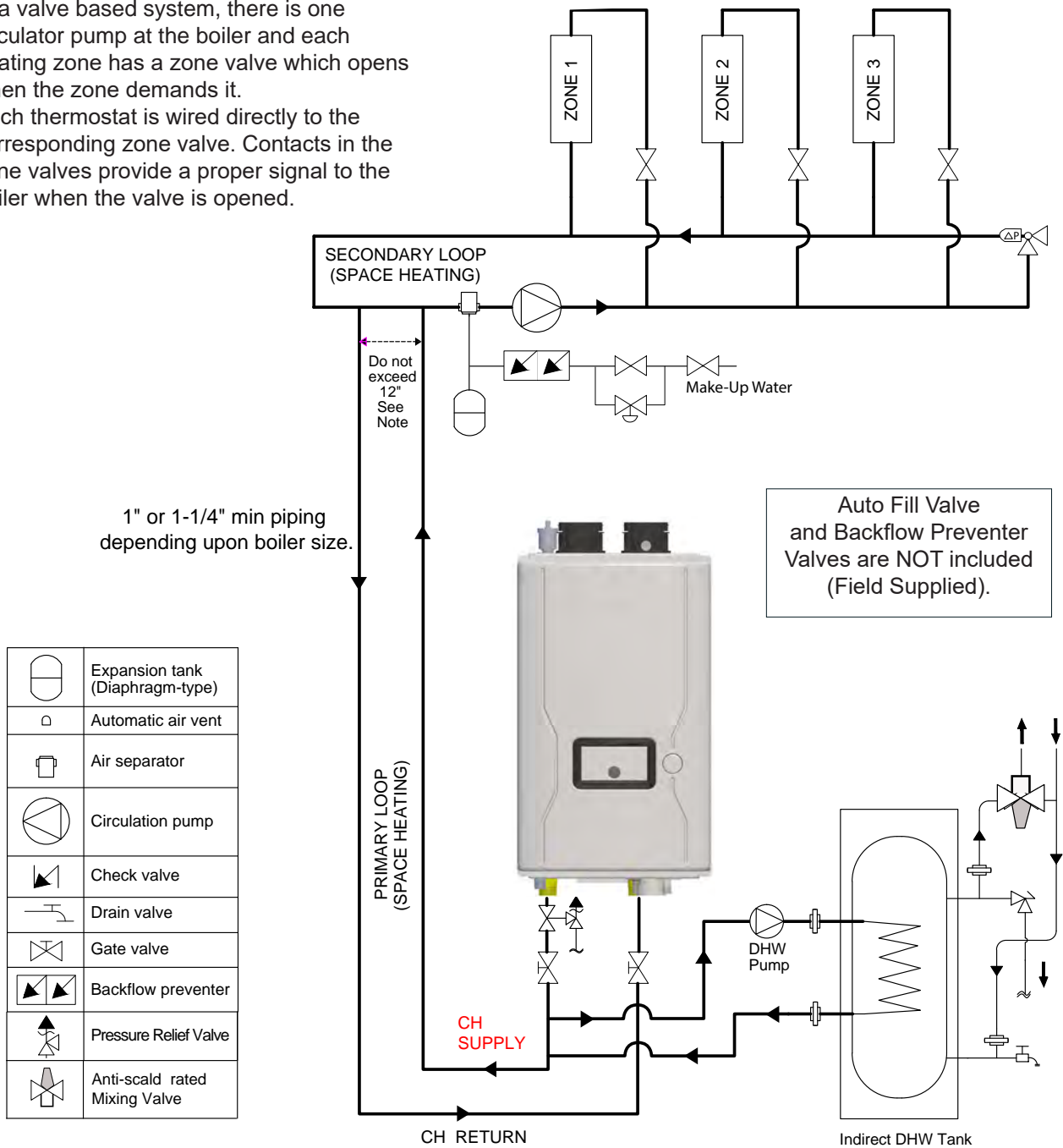
 CAUTION

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



4.14.4 Zoning with zone valves

- In a valve based system, there is one circulator pump at the boiler and each heating zone has a zone valve which opens when the zone demands it.
- 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.

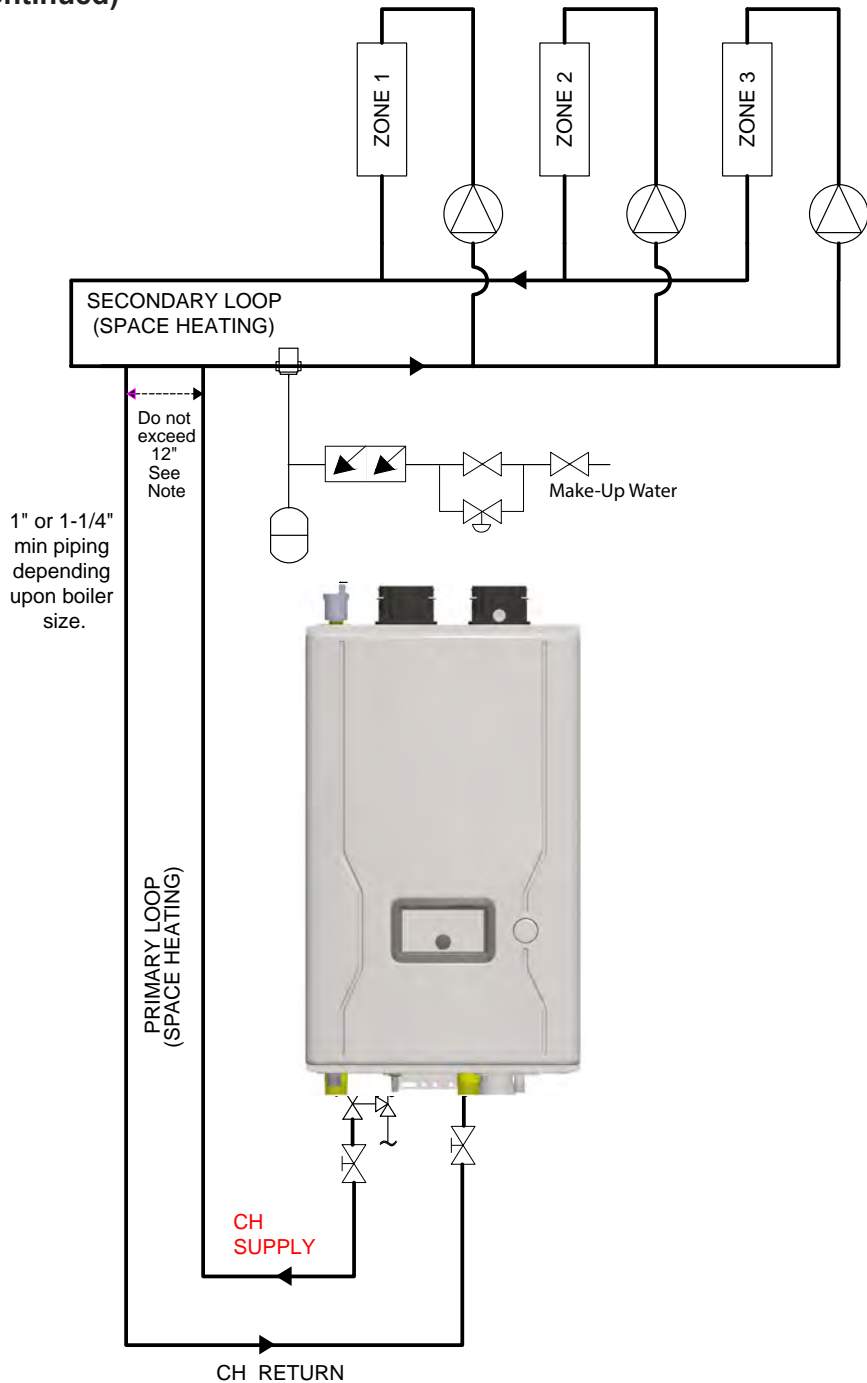


1. This piping diagram is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be 12" (or 4 pipe diameters) center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
5. 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.
6. It is strongly recommended to use a 10 kOhm sensor for DWH sensing, especially in high temp DHW applications.

4.14 Plumbing Guidelines (continued)

4.14.5 Zoning with circulation pumps

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

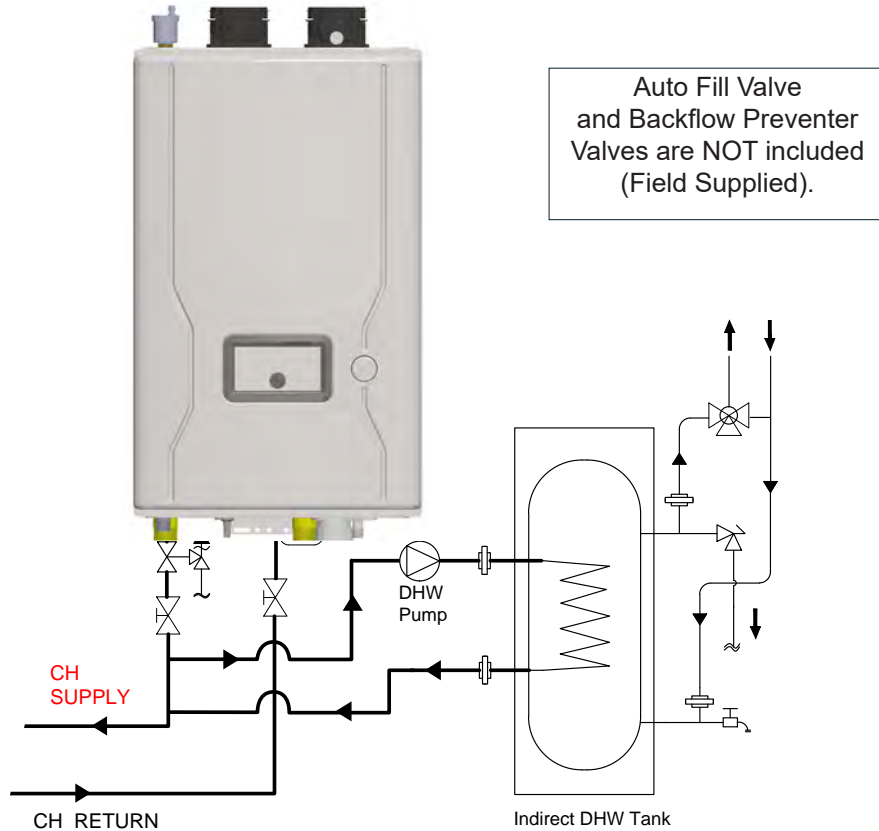


	Expansion tank (Diaphragm-type)
	Automatic air vent
	Air separator
	Circulation pump
	Check valve
	Drain valve
	Gate valve
	Backflow preventer
	Pressure Relief Valve
	Anti-scald rated Mixing Valve

1. This piping diagram is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be 12" (or 4 pipe diameters) center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
5. 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 Indirect Water Heating

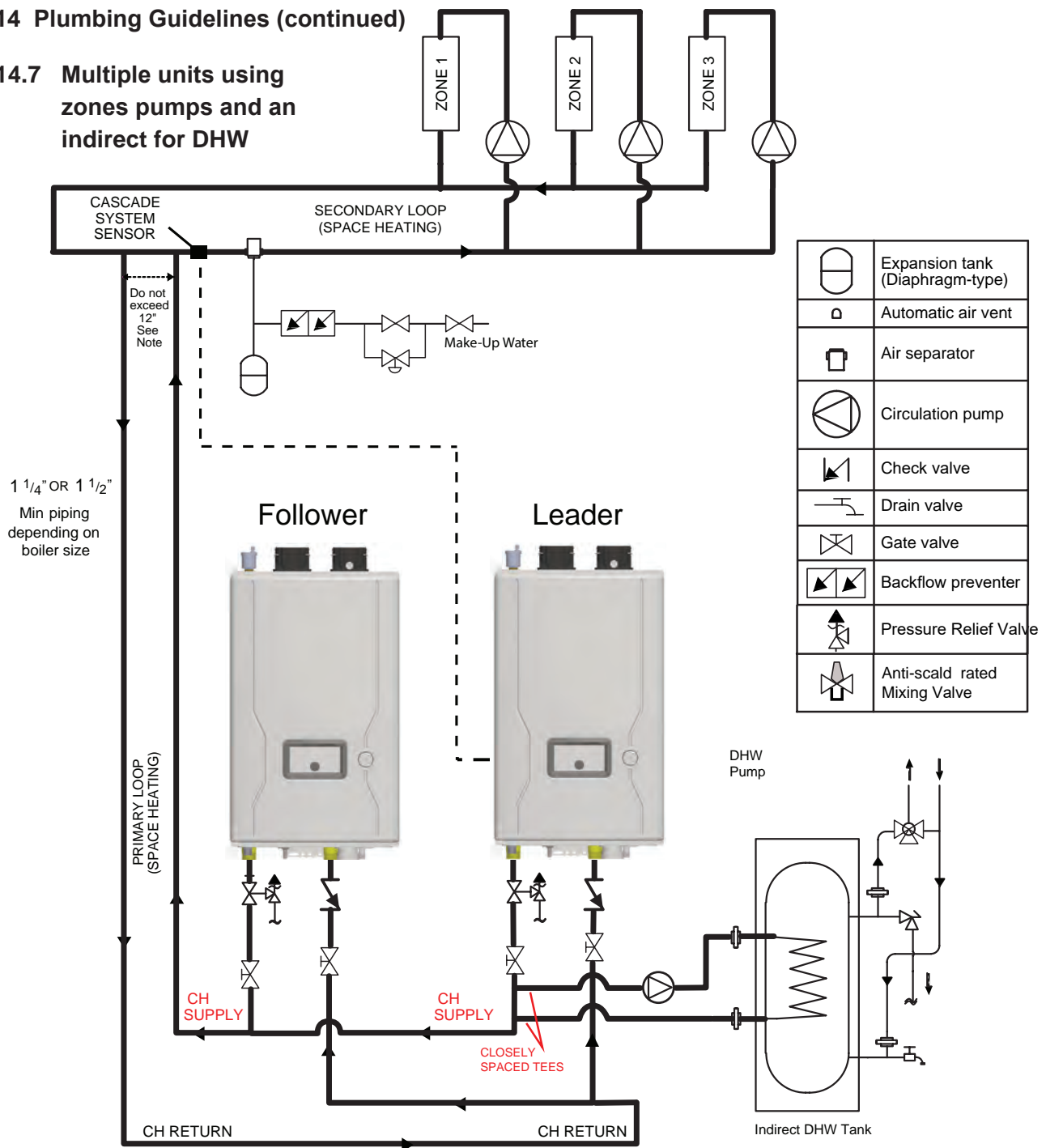
- Installer is responsible for all equipment and detailing required by local codes.
- The minimum pipe size of CH piping should be 1 ¼" in diameter.



1. This piping diagram is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be 12" (or 4 pipe diameters) center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
5. 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.
6. It is strongly recommended to use a 10k Ohm sensor for DWH sensing, especially in high temp DHW applications.

4.14 Plumbing Guidelines (continued)

4.14.7 Multiple units using zones pumps and an indirect for DHW



1. This piping diagram is meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
2. All closely spaced tees shall be 12" (or 4 pipe diameters) center to center spacing.
3. A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
4. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
5. Install a check valve on the return line to the boiler.
6. 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.
7. Auto Fill Valve and Backflow Preventer Valves are NOT included (Field Supplied).
8. DHW Sensor/Aquastat must connect to LEAD boiler. It is strongly recommended to use a DHW sensor in case of high DHW set points.

4.15 Pressure Relief Valve

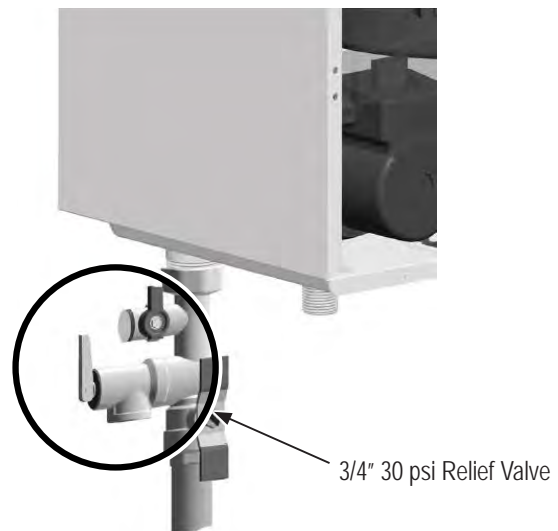
- External pressure relief valves must be installed. Observe the following. Failure to comply with the guidelines on installing the pressure relief valve and discharge piping can result in personal injury, death or substantial property damage.
- This boiler is provided with 30 psi safety relief valve 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.
- For safety, the relief valve(s) must be installed as close to the boiler as possible on the boiler supply pipe and not 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.
- 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 boiler.
- Ensure that the maximum BTU/H rating on the pressure relief valve is equal to or greater than the maximum input BTU/H rating of the boiler.
- Pressure Relief Valve must be installed on the CH supply line as close to the unit as possible. (CH supply line: maximum 30psi). 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.

⚠ WARNING

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

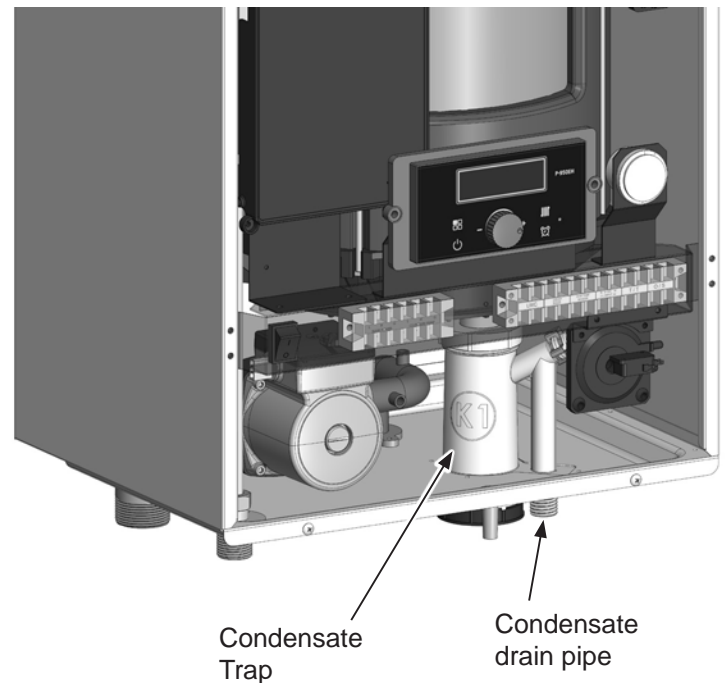
⚠ WARNING

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



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 3 disposal methods must be followed
 1. to floor drain
 2. to neutralizer (optional kit)
 3. 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.



⚠ NOTICE

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

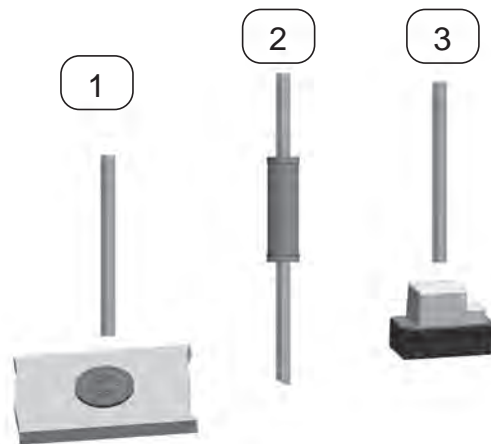
⚠ AVIS

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

⚠ CAUTION

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

Contact Manufacturer to order
 Neutralizer Kit# A2123601



Various condensate disposal methods

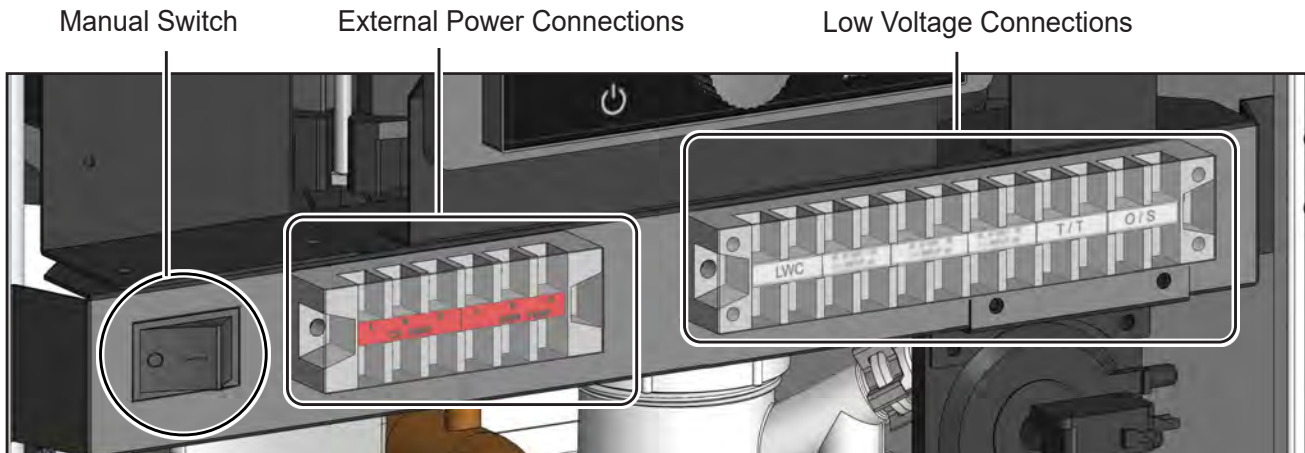
4.17 Electrical Wiring Connections

⚠ WARNING

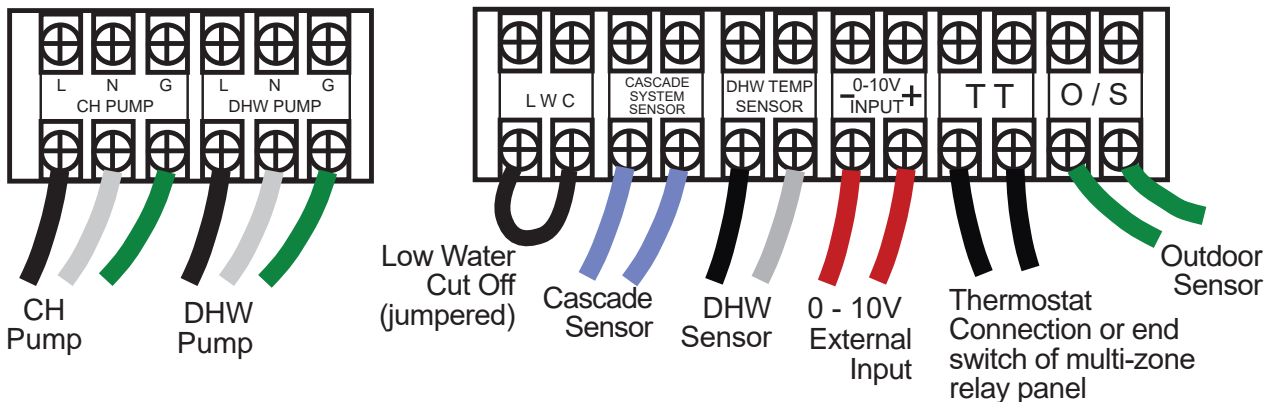
Install wiring and electrically ground boiler in accordance with authority having jurisdiction or, in the absence of such requirements, follow the National Electrical Code, NFPA 70, and/or CSA C22.1 Electrical Code-Part 1 in Canada.

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 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 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)



Electrical Connections

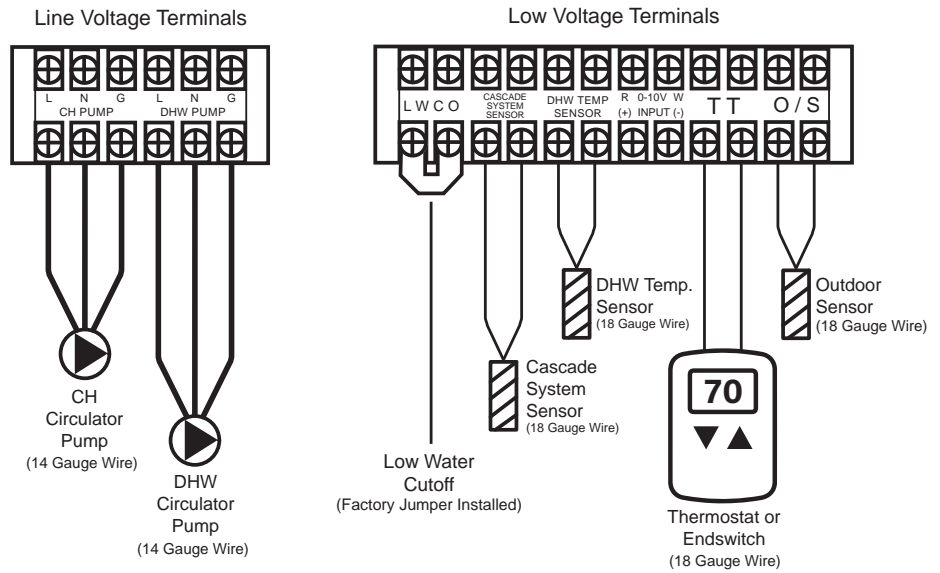


DHW and CH pump terminals for external pump are live 120V limited to 2.0 A. They operate respective to an external call (e.g T-T) for heat.

-continued on next page

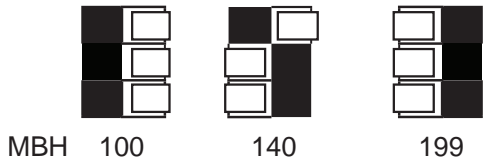
4.17 Electrical Wiring Connections (continued)

NOTE: Do NOT connect a 24V thermostat to the T-T terminals. Only connect a dry contact closure to T-T.



4.18 DIP Switches

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

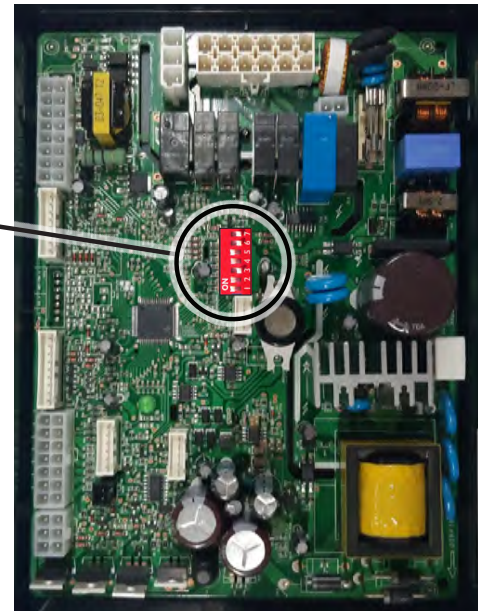


These 3 bottom switches must be set per unit SIZE.

Table B DIP Switch Settings



Shown is a Model 140 with 3" Venting and using Natural Gas

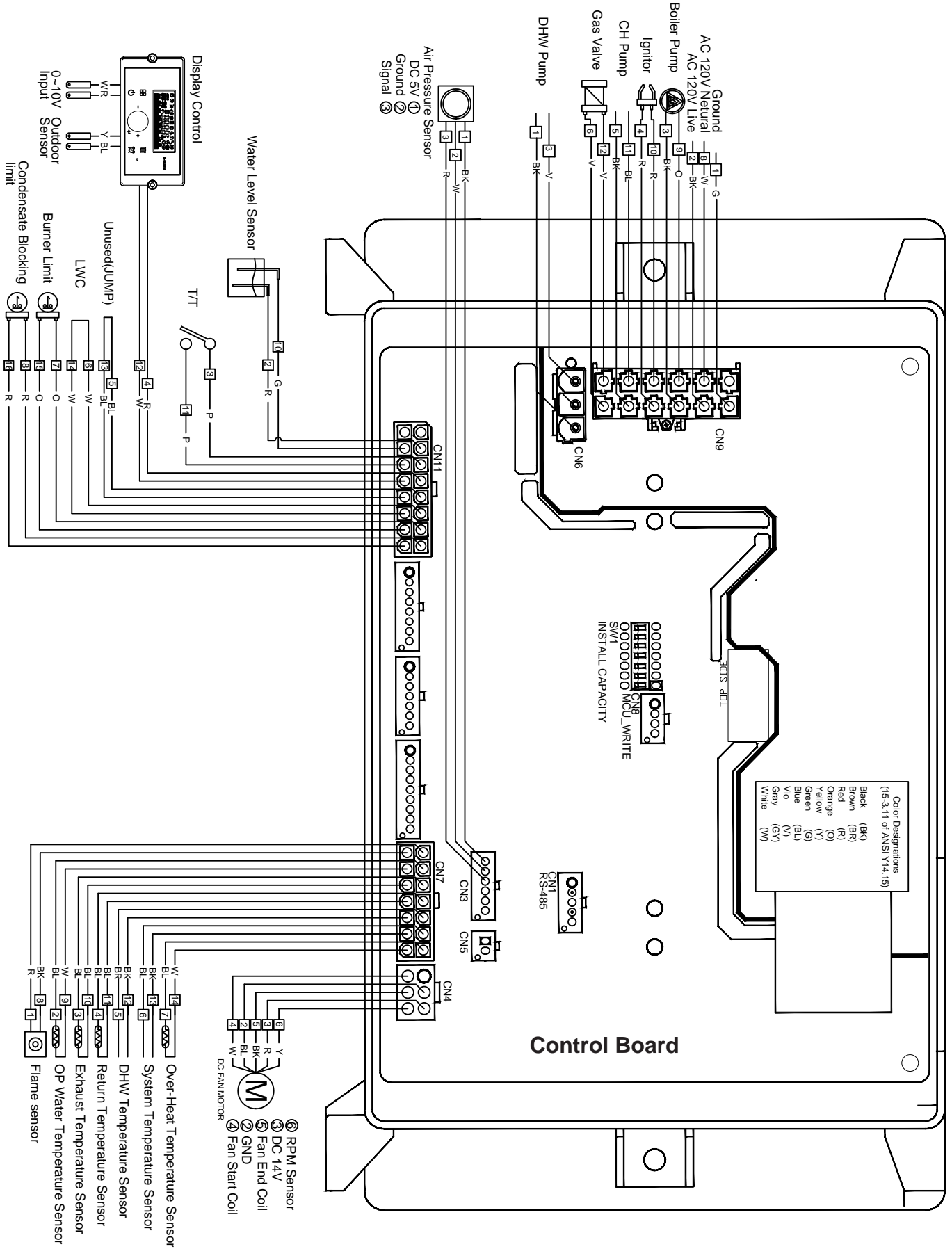


- Dip switches 6 and 7 must be set to OFF position during regular operation.
- DIP switches 1, 2 and 3 are system switches, are factory set and should not be touched unless replacing the control in which case switches must be configured for the right size boiler.

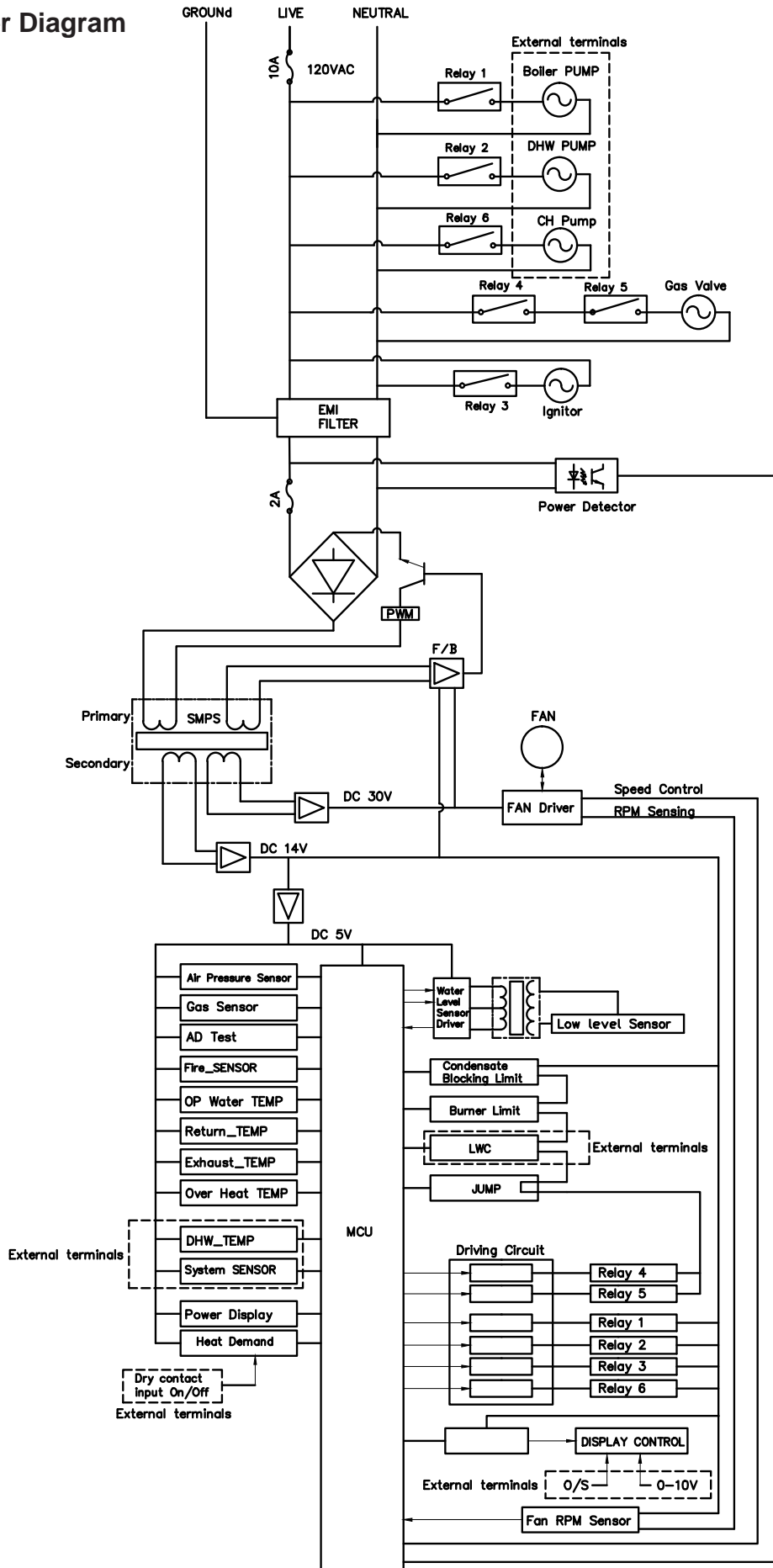
System Control Setting

Maximum flame detecting voltage	2.4V
Pre-purge time T _p	Maximum 10s, minimum 1s
Safety Time (igniting time) T _s	1.5s
Igniting interval time	10s
Post-purge time T _{ip}	120S (1st : 60s + 2nd 60s)
Over-heating 1,2,3 protection detection time	<2s
High & Low Water Level detection time	<5s
High & Low Water Level Recover time	<5s
Temperature sensor anomaly detection time	<3s
APS sensor detection time	<3s


4.19 Control Board, Electrical Diagram



4.20 Ladder Diagram



4.21 Electrical Connections

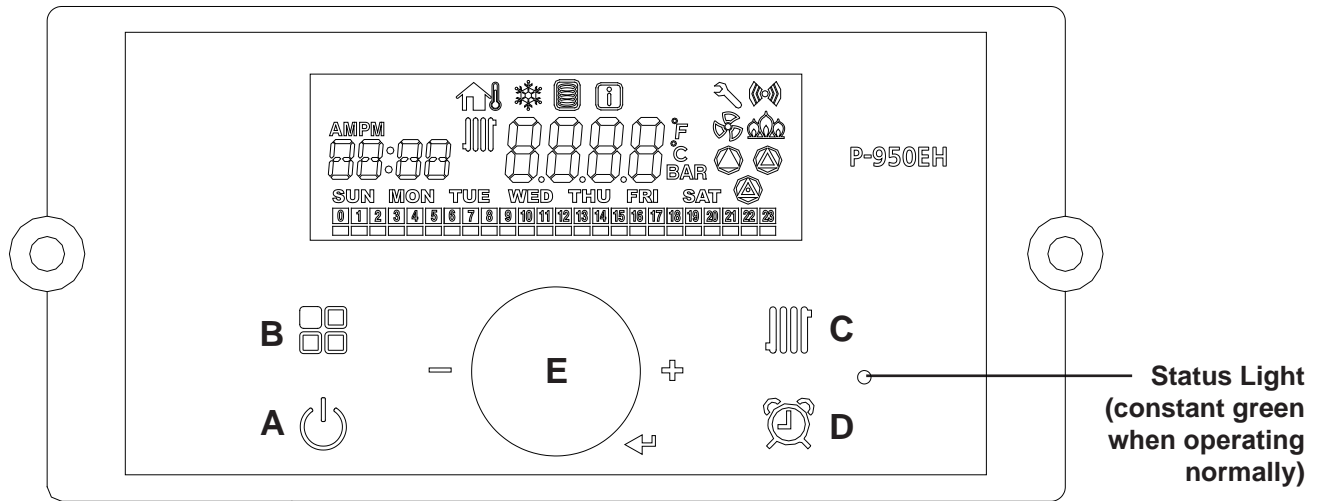
Connector			Description	HT SELV
#, Location, Type	PIN	Label		
CN9 65001WS-12	1		CASE GROUND	HT (120V~)
	2	L	Power Supply Line	HT (120V~)
	3	CP1	Central Heating Pump	HT (120V~)
	4	IT	Ignitor	HT (120V~)
	5	HEAT/CP2	CH Pump	HT (120V~)
	6	GV	Gas Valve	HT (120V~)
	7	-	-	-
	8	N	Power Supply Neutral	HT (120V~)
	9-12	~ N ~	AC Power COM Line	HT (120V~)
CN6 LW6A4-03	1	CP3	DHW Pump connection	HT (120V~)
	3			HT (120V~)
CN1 SMW250-05D	1	RS-485	RS485 +	SELV (5V)
	2		RS485 -	SELV (5V)
	3		-	-
	4		RS485 +	SELV (5V)
	5		RS485 -	SELV (5V)
CN4 LWD1140-06D	1	FAN	Unuse	-
	2		GND	SELV (30V)
	3		VDD	SELV (14V)
	4		Fan power(start coil)	SELV (30V)
	5		Fan power(end coil)	SELV (30V)
	6		Fan speed feedback signal	SELV (14V)
CN8 SMW250-04D	1	MCU ISP	GND	SELV (5V)
	2		ISP /Reset port	SELV (5V)
	3		ISP TOOL0 Data port	SELV (5V)
	4		VCC	SELV (5V)
CN11 LWD 1140-16	1	HWL	AC 24V Input Heat Demand	SELV (12V~)
	9			
	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	Unuse	-
	13			
	6	EL	Unuse	-
	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 (5V)
	8			
	2	OP.S	Operating water temperature sensor	SELV (5V)
	9			
	3	DH.S	Exhaust temperature sensor	SELV (5V)
	10			
	4	I.S	CH Return temperature sensor	SELV (5V)
	11			
	5	BG.S	DHW temperature sensor or Mechanical aquastat connection	SELV (5V)
	12			
	6	ST.S	System temperature sensor	SELV (5V)
	13			
	7	SP.S	CH over-heat temperature sensor	SELV (5V)
	14			
CN3 SMW250-06D	1	APS	VCC	SELV (5V)
	2		GND	SELV (5V)
	3		Voltage input	SELV (5V)
	4-6	FLUX1	Unuse	-

SECTION 5 Control Display and Operation

5.1 Control Dial and Buttons



The Control Display

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

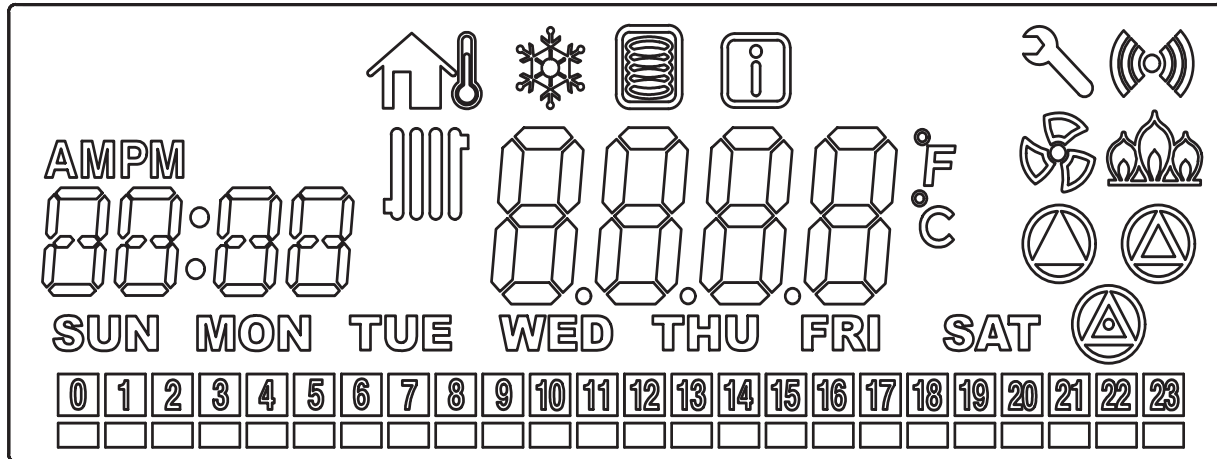
Buttons			Functionality	
			PRESS (Tap)	PRESS and HOLD (5 seconds)
A		Display Power	Turns Control Display ON/OFF	
B		Modes	Tap to return to menu	(If Display Power was On) Status Display Mode (If Display Power was Off) Installer Mode
C		Heating Water	CH set point change mode (Maximum 82°C(180°F))	
D	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

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

WARNING

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

5.2 LCD Overview




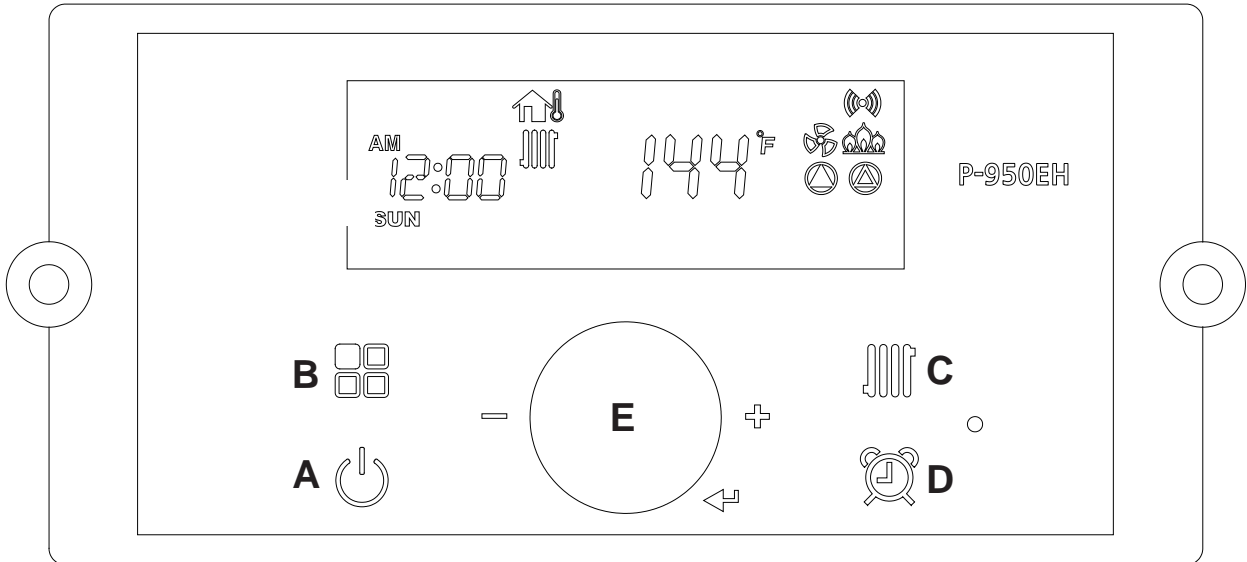
Symbol	Name	Description
	Service Reminder mode	Service Reminder mode indication
	Outside Temperature Mode	Outside Temp setting indication
	Anti-freeze mode	Anti-freeze mode indication
	Storage mode	Storage mode indication
	Information mode	Information mode indication
	Communication state	Communication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








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

5.3 Operating Mode

■ Operating Mode

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



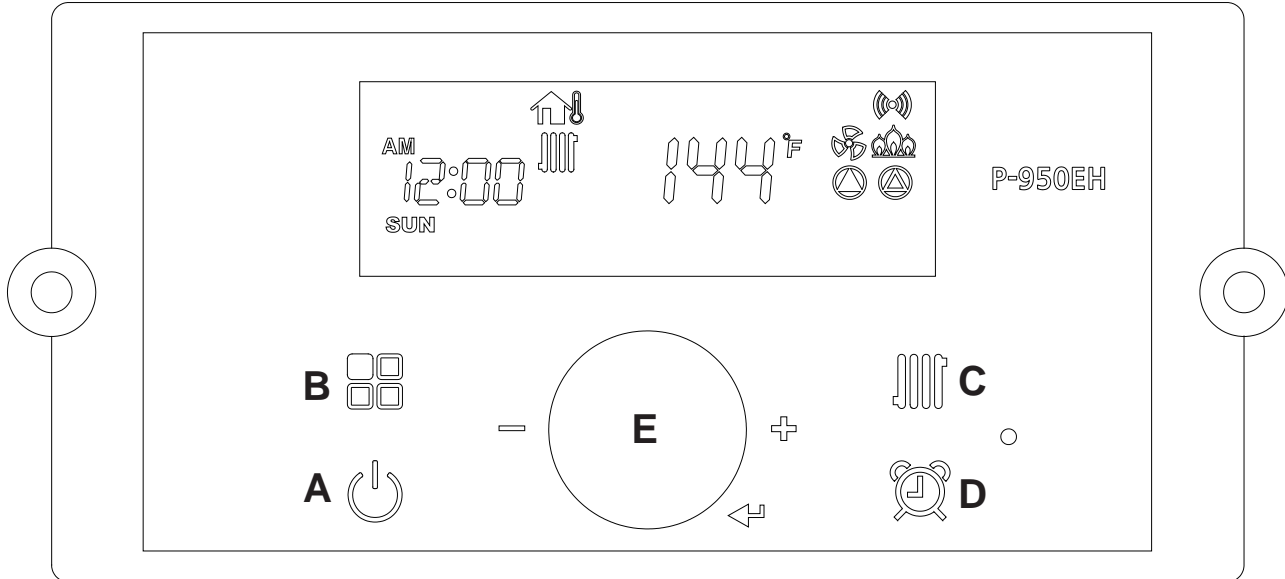
Indicate	Indicator
Current Operating Temperature Set point	144°F
If the Fan is operating	
If a flame is detected	
Celsius or Fahrenheit	°C or °F
Date and Time indicator	AM PM 88:88
If Outside Temperature Sensor is operating	
If there is a Demand for Central Heat (CH)	
If CH pump state is operating	
If Internal recirculation pump is operating	
If Communication state is activated	

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

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


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


5.4 Setting the Clock



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

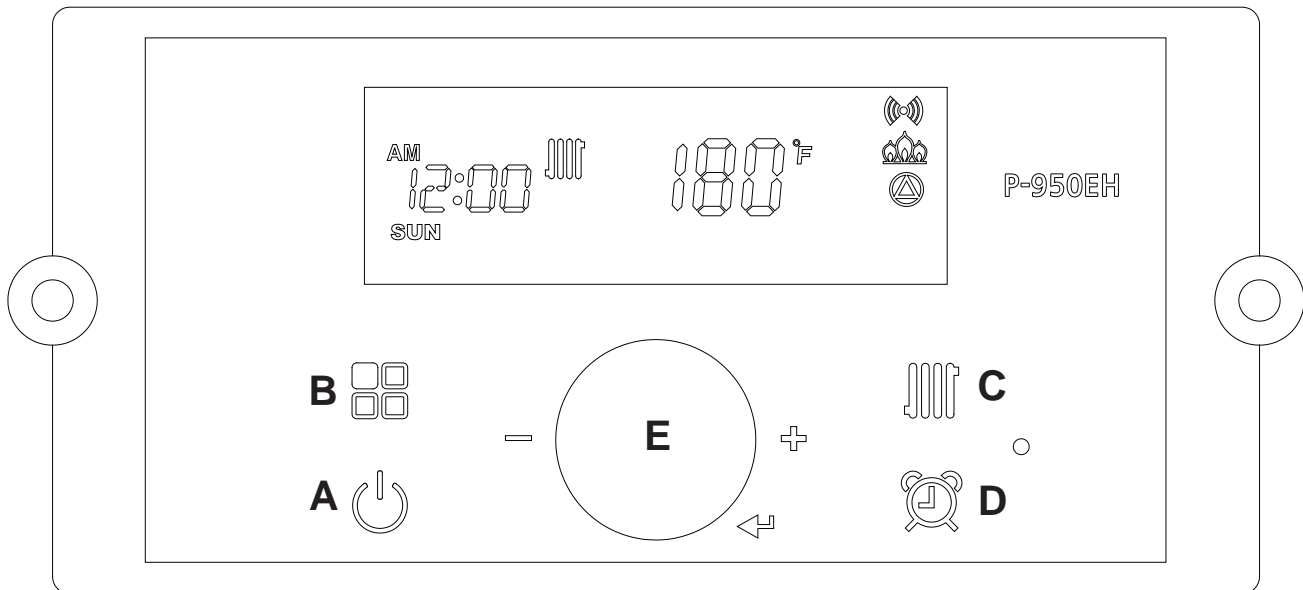
Setting the Clock


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






To Exit at any time, tap the  button.

5.5 CH Set Point Change Mode

- CH Set point Change Mode




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

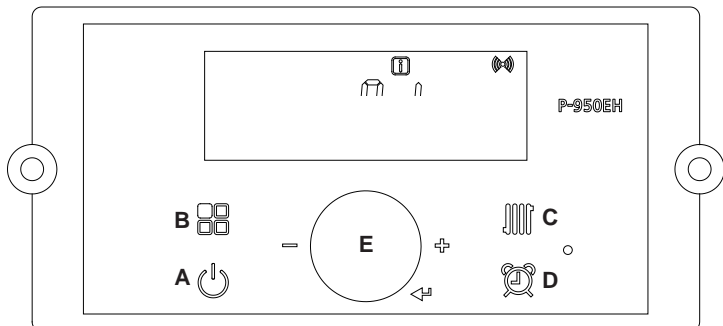
Indicate	Indicator
Current CH Temperature Set point	
Celsius or Fahrenheit	°C or °F
If Communication state is activated	
If flame is detected	
Date and Time indicator	AM PM 00:00
If CH pump is operating	
If there currently a Demand for Central Heat (CH)	

Default CH set point is 180°F (82°C)
 CH set point range is 130°F ~180°F (54°C ~ 82.0°C)

5.6 Status Display Mode

To view any Status Parameter,

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

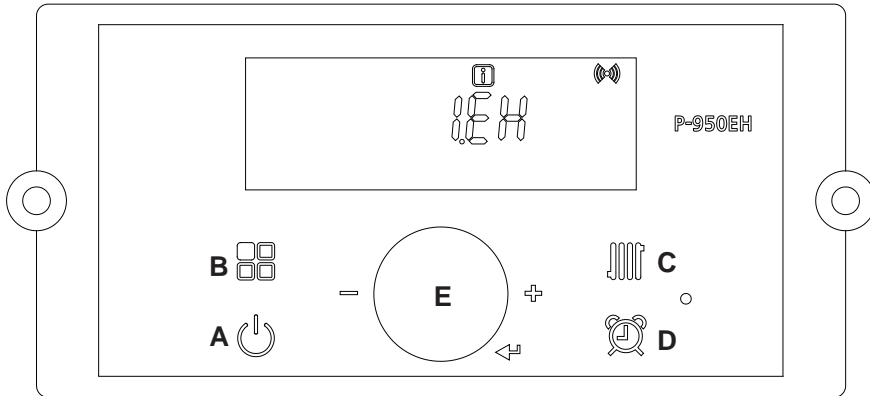


NOTE: For Cascading Installations, please refer to document 1349 'Cascading the FT Series Boiler', available online.

Digital Display	Status Display Parameter	Description		
O: ot	Outdoor temperature	Current outdoor sensor temperature		
A: In	0-10 V display	Current voltage of (0-10V input)		
b: tt	CH target temperature in cascade system	Current CH target temperature or Current System target temperature in a cascade system		
C: It	CH return water temperature	Current CH return water temperature		
d: Fr	FAN speed (rpm)	Current FAN speed (RPM)		
E: oP	CH supply temperature (Operating temperature)	Current heating temperature		
F: Eh	Exhaust gas temperature	Current exhaust gas temperature		
H: dH	Indirect DHW tank temperature * If temperature sensor is not connected then it will display with 0°F (0°C).	Current DHW tank temperature		
I: oH	Overheat water temperature	Current Overheat water temperature		
L: rt	1: PH	Time for supply power	L: rt on display on sub menu	Unit : 1000hour
	2: rh	Time for burner operation		Unit : 1hour
	3: rH	Time for burner operation		Unit : 1,000hour
	4: It	Cycle for ignition		Cycle : 10 times the displayed unit
	5: IH	Cycle for ignition		Cycle : 10,000 times the displayed unit
M: CC	SELF	Percentage of self units running.	Percentage of self units running.	
	ALL	Capacity for all operating cascade units	Percentage of all cascade units running. This screen shows the overall cascade power output. The range of this value of boilers communicating with the Master x 100. For example, if 8 boilers are connected and communicating, the maximum cascade power is 800%. Range: 0-100%	
	F1 – F19	Capacity for individual boilers	Percentage of each cascade units running. Ex. F1, F2,	
N: St	System Temperature (cascade mode) * If system temperature sensor is not connected then it will display with 0°F (0°C).	Current System Temperature (cascade mode)		

5.7 Installer Mode


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



WARNING


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

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

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

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

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

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

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

5.7 Installer Mode (continued)

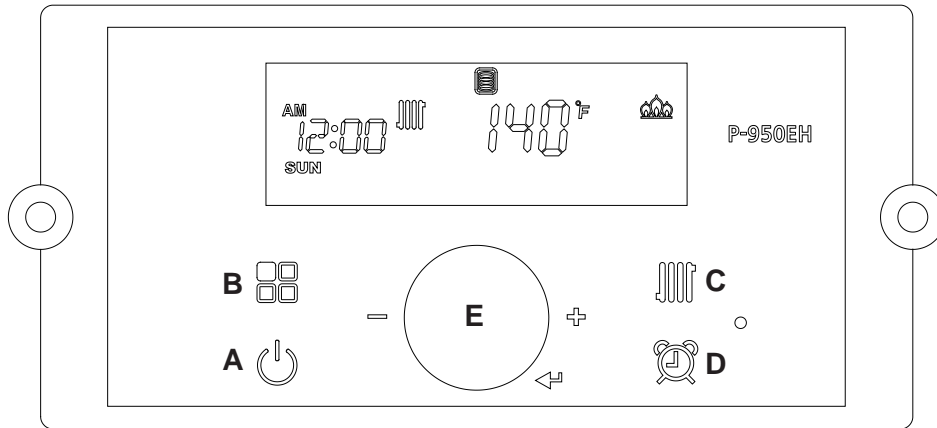
Index Numbers	Parameter	Description
7: cL	Minimum Supply temperature	Sets the design supply water temperature based on the maximum outdoor design temperature. Minimum supply temperature must be set at least 9°F below the maximum supply temperature. Range: 40°F to (Maximum Supply Temperature - 9°F) , Default 130°F
8: OF	Warm Weather Shutdown	This warm weather temperature setting will shut down CH Mode Range : 50 °F- 110°F, Default 100°F
9: bt	Boost Function	This function boosts CH temperature to the maximum if set point is not reached within the set period of time. Range: 0 - 120 min, Default 0
10: bd	Boost Degree	The boiler will add this temperature to the boiler target set point based on outdoor reset curve. Range: 5-15°F Default: 10°F
11: bl	Boost Interval	The boiler will index the temperature based on time interval set on 11 bl. Range: 0-120 MIN Default: 20 MIN
12: FH	Maximum Fan speed	Adjusts Maximum Fan Speed Range: -30 to +30,Default 00
13: FL	Minimum Fan speed	Adjusts Minimum Fan Speed Range: -30 to +30,Default 00
14: dr	Initialized burner operation time	Select ON to Initialize burner operation time Range: NO or YES,Default NO
15: dl	Initialized ignition cycle	Select ON to Initialize ignition cycles Range: NO or YES,Default NO
16: Ft	CH Anti-Cycling time	This function delays burner operation during CH mode Range: 0 - 20 min, Default 1
17: bo	Set differential temperature to turn burner "ON"	When set, the appliance will operate to heat CH water when water temperature falls below a differential setting. Example: If set point is 180°F and differential is 27°F, the appliance will turn on when CH water temperature falls below 153°F. Range: 5°F - 30°F, Default 15°F
18: cb	Heating capacity	Set Heating combustion rate Range: 50 - 100%, Default 100
19: db	DHW capacity	Set DHW combustion rate Range: 50 - 100% , Default 100
20:PE	Heating Pump Post-Purge Time, T/T Satisfied	Allows the user to set the appliance pump post purge time once the thermostat is satisfied. Range: 1-5 minutes , Default 1
21: dH	Indirect Storage Tank Temperature Set Point	Sets Maximum Indirect storage tank Temperature Range:95 - 180°F , Default 120 °F
22: dd	Indirect Storage Tank Differential Set Point	DHW Differential Set Point Range: 5°F-30°F, Default 7 °F
23: Pr	DHW Pump Post Run Time	DHW Pump Post Run Time Range: 0-10 Min , Default 1 Min
24: dP	DHW Priority Timer	DHW Priority Timer Range: 0 – 60 Min , Default 30 Min
25: St	Boiler Supply Indirect Storage Tank Temperature	Boiler Supply Indirect Tank Temperature Range: 120 °F– 180 °F , Default 180 °F
26: FP	System Freeze Protection Mode	System Freeze Protection Mode. This mode should be turned OFF for snow melt application. NOTE: This mode should be ON during normal operation. Range: ON/OFF, Default: ON

Index Numbers		Parameter	Description
27: Cn		Cascade Number	Cascade Number Range: 0 (Master), 1(slave 1), ..., 19(slave 19) "29: CP" has to be set with the total number of units in the cascade before "28: Cn" can be set. Default 0
28: CP		Cascade Parameter	Number of units cascaded Range: 1- 20 , Default 1
29: Eh		Common Vent	Common Vent Range: ON / OFF, Default OFF
30:Cr	Auto	Automatic rotation	The first unit to operate when there is a T/T call is the unit that ran the least amount of time during the prior heat calls.
	Cr:Ct	Cascade Rotation time	Cascade Rotation time Range: 0-240 Hours, Default 48 Hours
31: Ct		Cascade System temperature	Cascade System temperature: Range: 9°F – 180°F, Default 180°F
32: Cd		Cascade System Temperature Differential (burner ON)	Cascade System Temperature Differential (burner ON) Range: 5°F-30°F, Default 10°F
33: HA		High Elevation Mode	High Elevation Mode (0-2, 2-5, 5-8, 8-10), Default HA 0
34:AP	AP:cP	Internal CH Pump, CH Pump and DHW Indirect Pump Test Mode	This function sets the time to run both the Internal CH and Internal DHW Storage pumps to purge air from the system. Range: 1 – 30 minutes,Default 5
	P1:oF or P1:on	Internal CH Pump and CH Pump Test Mode	Turn this function on to activate Internal CH and CH pump testing. Only works in installation mode. Turns off when in normal mode. Default OFF
	P2:oF or P2:on	Internal CH Pump and DHW Indirect Pump Test Mode	Turn this function on to activate Internal CH and DHW Indirect pump testing. Only works in installation mode. Turns off when in normal mode. Default OFF
35: SS	SS:Sd	Allows the user to set the year of next service reminder	Allows the user to set the year of next service reminder XX / XX / XXXX (MONTH / DAY / YEAR)
	SS: br	Allows the user to set the service reminder based on BURNER RUN HOURS	Allows the user to set the service reminder based on BURNER RUN HOURS (0: OFF, 1-9000Hours) , Default 0
36: UC	FAH(°F)	Allows the user to change the unit	Allows the user to change the unit Range: °F or °C
	CEL(°C)		
37: CM	OFF	CH Step Modulation	Allows the user to turn ON the step modulation, which regulates burner output in six steps at one minute intervals. Step modulation will start at the last modulation rate of the boiler and work up one minute at a time. Default: OFF (Selection: OFF or ON).
38: dM	OFF	DHW Step Modulation	
39: SA	AquA	Select Aquastat (contact) Type	This mode is aquastat (contact) type.
	SEnS	Select DHW NTC Sensor Type	This mode is NTC sensor type.
40: BP		Boiler Pump Operation	Allows user to specify internal boiler pump operation whereby an external pump can "push" through the internal boiler depending on piping application. Range: ON/OFF Default: ON

NOTE: If Parameter 39 does not appear in the Installer mode, reset the unit using Parameter 3. After a factory reset, Parameter 39 will again appear.

5.8 Storage Mode

■ Storage Mode / Indirect Water Heater







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

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

Rotate Dial E until you find **25:St** Tap Dial E to enter Storage Mode. Storage Mode indicates that the boiler is heating the water held in an indirect water heater. When Storage Mode is active, the display will appear as shown.

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

Press E dial to save changes and to Exit.

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


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

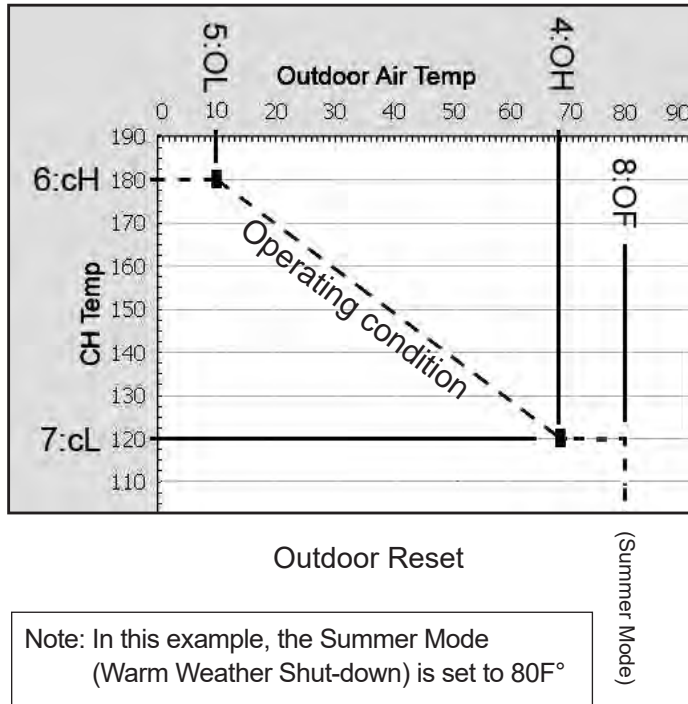
5.9 Outdoor Reset Adjustment

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

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

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

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



Connect to terminal strip as outlined 4.17 Electrical Connections.

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

5.10 External Set Point Temperature Control

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

The control interprets the 0-10 volt signal as follows; when the signal is between 0 and 1.5 volts, the appliance will be in standby mode, not firing. When the signal rises above 1.5 volts, the appliance will ignite. As the signal continues to rise towards its maximum of 10 volts, the appliance will increase in set point temperature. Adjust **6:cH** and **7:cL** to set MIN and MAX boiler water temperatures respectively.

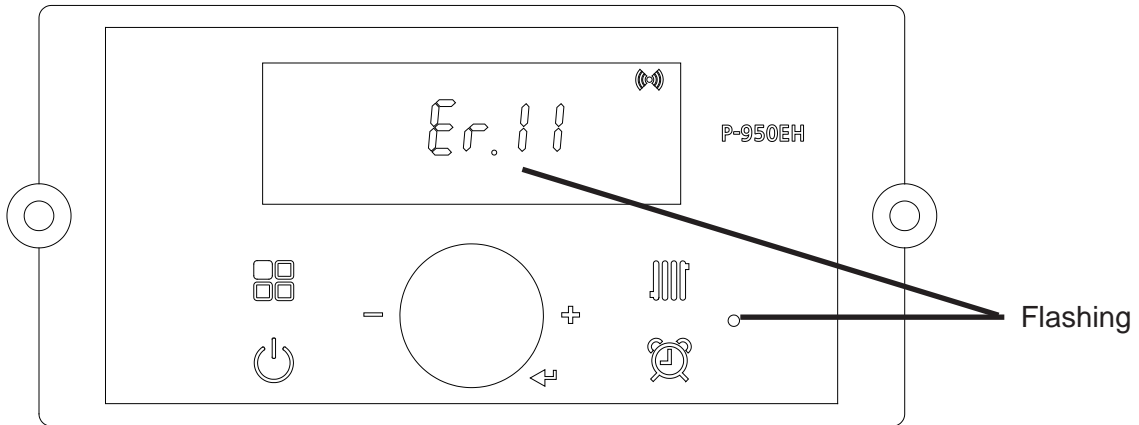
Connect a building management system or other auxiliary control signal to the terminals marked for this purpose on the appliance terminal block (shown in Piping Diagrams, this manual). Caution should be used to ensure that the 0-10 VOLT + connection does not become connected to ground.

Connect to terminal strip as outlined 4.17 Electrical Connections.

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

5.11 Error Mode

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



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

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

SECTION 6 Error Codes

6.1 Error Code Table

Error Code	Error Code Description	Possible Remedies	Recover methods
10	Flame has Extinguished 8 (Eight) Times	<p>Press the Power button to clear the Error Code.</p> <p>If Error happens again:</p> <ol style="list-style-type: none"> 1. Monitor the gas pressure to the appliance while in operation. Ensure pressure is between 3.5" to 10.5" WC (Natural Gas) and 8" to 13" WC (Propane). 2. Check gas valve wire. Ensure connection is secure. 3. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 4. Check exhaust and intake terminations for blockages. Also verify that intake, intake boot, blower and burner housing is free of blockages and debris. 5. Assure that the flame is stable when lit. Confirm Flame stability by manually forcing the boiler into Low Fire (see section 4.20) - Burner should not cycle on and off in low fire. If burner cycles on/off during low fire operation adjust fuel/air mixture and confirm CO2 values are within range for model and fuel type. 6. If the problem persists, contact technical support. 	Hard Lock
11	Ignition has Failed 10 (Ten) Times	<p>Press the Power button to clear the Error Code.</p> <p>If Error happens again:</p> <ol style="list-style-type: none"> 1. Monitor the gas pressure to the appliance while in operation. Ensure pressure is between 3.5" to 10.5" WC (Natural 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, contact technical support. 	Hard Lock
16	Operating Temperature Sensor detects Water Temperature Greater than 203°F (95°C)	<p>Press the Power button to clear the Error Code.</p> <p>If boiler is not piped Primary/Secondary it is likely the internal boiler pump is not able to move enough water thru heat exchanger.</p> <p>If Error happens again:</p> <ol style="list-style-type: none"> 1. Check if dip switch Max Fire setting is ON. Switches 6 and 7 should be OFF for normal operation. 2. Check if CH inlet pipe is blocked. Ensure there is enough water flowing to the appliance. 3. Check Operating Temperature sensor at CH heat exchanger outlet. If resistance is zero, replace the sensor. 4. Verify operation of internal boiler pump by checking rotation of pump shaft. (Manually spin pump shaft by removing round cap at back of the pump and insert a flat head screwdriver. 5. If the problem persists, contact technical support. 	Hard Lock
20	Condensate – Closed is Normal, Open is Fault (Condensate Drain Trap)	<p>Press the Power button to clear the Error Code.</p> <ol style="list-style-type: none"> 1. Check Condensate and main controller connections. Ensure all are secure. 2. Check Condensate sensor resistance. If resistance is zero, replace the switch. 3. Check Condensate hose. Ensure it is connected and in good condition. 4. Check condensate line and termination for blockages. 5. Check Vent Pipe for blockages. 6. If condensate is "hard piped", add a vent in condensate piping higher than condensate trap. Supplied hose has a vent provided. 7. If the problem persists, contact technical support. 	Hard Lock
28	Overheat Sensor Open or Short	<p>This Error Code will go away when CH temperature decreases.</p> <p>If Error happens again:</p> <ol style="list-style-type: none"> 1. Check overheat temperature sensor. Ensure connections are secure. 2. Check overheat sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, contact technical support. 	Soft Lock
29	Poor Connection or loose wire at PCB board	<p>Press the Power button to clear the Error code.</p> <p>The error occurs when the blue wire inside the KI-I9CCWL 16 pin plug (upper left corner of PCB board) is shorted to ground or has a poor contact. Correct wiring.</p>	Hard Lock
32	DHW Sensor Open or Short	<p>This Error Code will go away when outlet DHW temperature decreases.</p> <p>If Error happens again:</p> <ol style="list-style-type: none"> 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, contact technical support. 	Soft Lock
33	CH Temperature Sensor Open or Short	<p>This Error Code will go away when CH temperature decreases.</p> <p>If Error happens again:</p> <ol style="list-style-type: none"> 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, contact technical support. 	Soft Lock

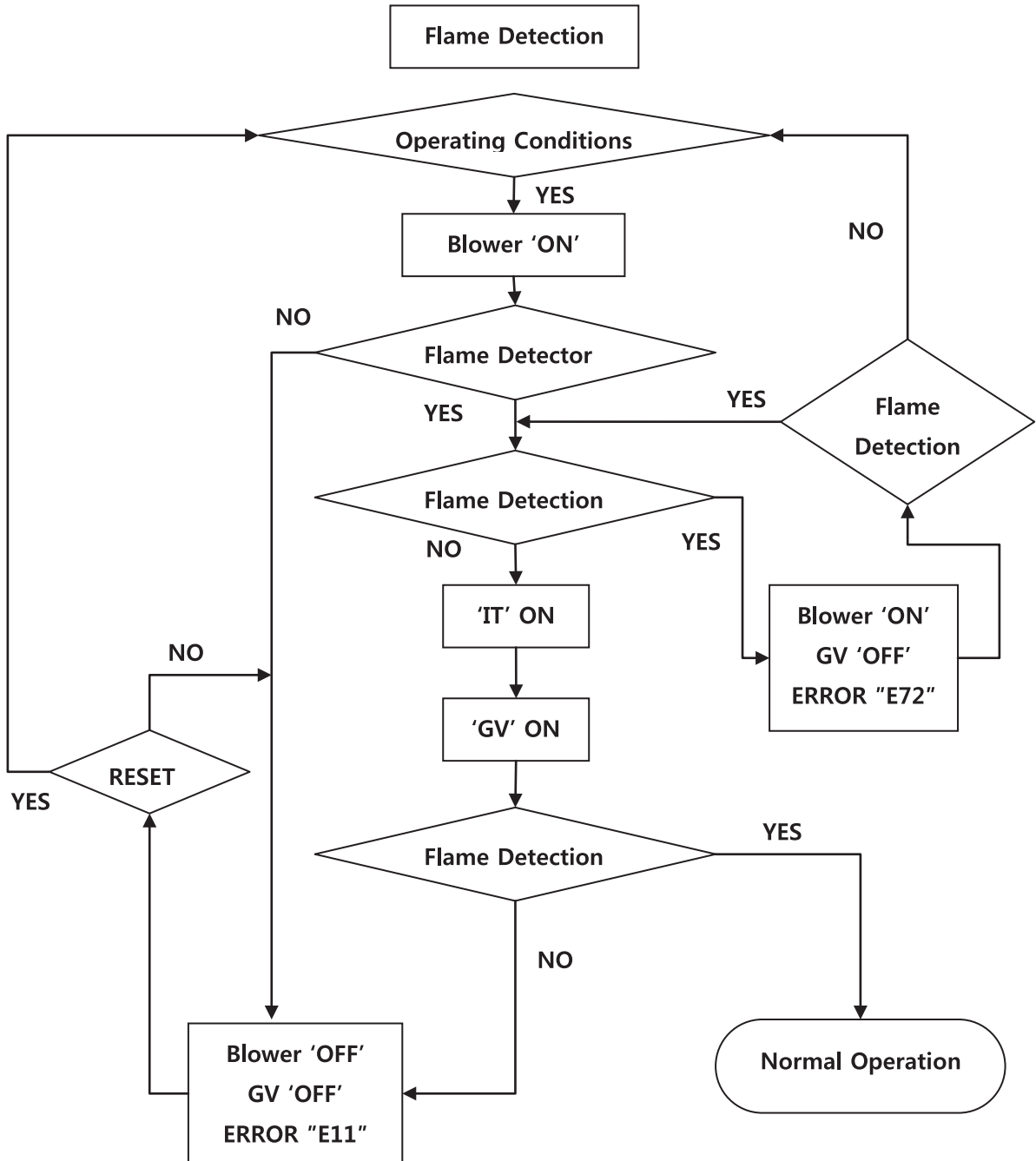
Error Code Table (continued)

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, contact technical support.	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, contact technical support.	Soft Lock
38	Error Appears When Control Stores Data, but Data is not Saved	Press the Power button to clear the Error Code. If the problem persists, contact technical support.	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, contact technical support.	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, 4. Check intake and exhaust for blockages, debris, proper installation and placement. Check and record SFN (revision # of printed circuit board during start-up for future reference.) 5. If the problem persists, contact technical support.	Hard Lock
42	LWCO Jumper Disconnected	Press the Power button to clear the Error Code. If Error happens again: 1. Ensure the LWCO Jumper is properly connected. 2. If the problem persists, contact technical support.	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, contact technical support.	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 air intake pipe for blockages. 3. inspect the Venturi and fan motor, the air intake screen at the fan connection (for the 140 only) or the burner itself for any debris that could have been drawn in by the fan thru the air intake. 4. If error do not clear, replace the aps 5. If the problem persists, contact technical support.	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, contact technical support.	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. Check intake and exhaust for blockages and debris. 3. If the fan does not rotate during the ignition sequence, check for AC8V~26.5V power at the fan connection. If AC8V~26.5V power is present at the control, replace the fan. If the blower does not have AC8V~26.5V power, check power at the control. If AC8V~26.5V power is not present at the control, replace the control. 4. If the problem persists, contact technical support.	Soft Lock

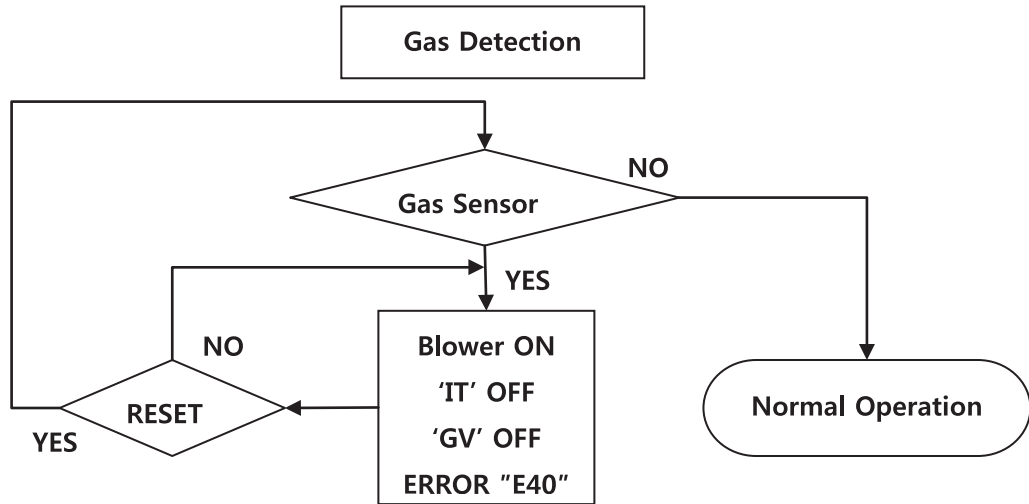
Error Code	Error Code Description	Possible Remedies	Recover methods
70	Register, Ram, Rom, I/O Port, AD Abnormal, Important EPROM Data or Safe Data Abnormal	This Error Code will go away when the condition is remedied. If Error happens again: 1. Turn power OFF and ON at the main power switch internal to the appliance. 2. If the problem persists, contact technical support.	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. Look thru boiler sight glass and check for glowing after burner shutdown, if so, do step 3. 3. Check burner plate by removing blower and boiler top plate and remove any debris from top of burner plate. Debris can come from PVC shavings during intake installation and/or from nearly dryer vents and landscapers causing debris pulling in thru air intake. Debris can glow after burner shut-down. 4. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 5. If the problem persists, contact technical support.	Soft Lock
76	Poor Communication (Control Display)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check connections from main control to display panel. 2. If the problem persists, replace the display and/or contact technical support.	Soft Lock
77	Outdoor Sensor Error	1. Check outdoor sensor wiring and make sure all connections are proper and secure. 2. Check resistance of outdoor sensor. If resistance is zero, replace sensor. 3. If the problem persists, contact technical support.	Soft Lock
78	Cascade Error	Please refer to Manufacturer's Document 1349 for Cascading the FT.	
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, contact technical support.	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, contact technical support.	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. 3. Check wiring connections to low water level sensor. Ensure all are secure. 4. Check low water level sensor resistance. If resistance is zero, replace the sensor. 5. If the problem persists, contact technical support.	Soft Lock
94	Exhaust Sensor detects Vent Temperature is Greater than 190oF (88oC)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check if dip switch Max Fire setting is ON. Switches 6 and 7 should be OFF for normal operation. 2. Check exhaust temperature sensor. Ensure connections are secure. 3. Check sensor resistance. If resistance is zero, replace the sensor. 4. Check exhaust vent for blockage. 5. If the problem persists, contact technical support.	Soft Lock

6.2 Fault Tree Analysis

6.2.1 1. Flame detection

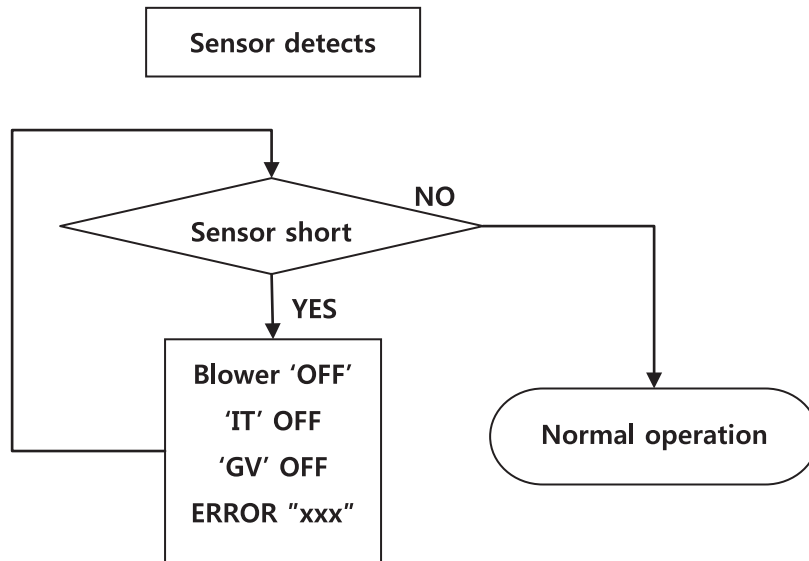


6.2.2 2. Gas Detection



6.2.3 Sensor detects

'Storage', 'DHW', 'OP', 'CH overheat', 'Exhaust heat'



Error code	contents
E28	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 Display has been turned ON.
	If the monitor on the Control Display 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 Display. 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	Potentially the domestic water flow is 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 10 degrees F (5.5 degrees C)

7.2 Suggested Corrective Actions

This controller is able to record information about the boiler’s condition at the time of the five previous faults or errors. Refer to the Section ‘5.10 Error Mode’ of this manual.

Display	Condition	Diagnostic	Corrective Action(s)
Nothing shown on display Control Display 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 Display 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 Display, but boiler is operating.	Occurs when the communication is lost from the control to the display.	Check for loose connections and proper pin alignment/engagement on the Control's plug.	Check for continuity on the wire harness from the display to the control. See repair parts section for proper replacement part.
		Cycle power off and on using boiler power switch and check for operation.	Replace with new display module. See repair parts section for proper replacement part.

7.2 Suggested Corrective Actions (continued)

Fault	Condition	Diagnostic	Corrective Action(s)
TEMPERATURE SENSOR	Occurs when a temperature sensor has electrically shorted (SHORT) or has become disconnected (OPEN).	Reset using manual reset screen on Control Display. (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 Display. (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 Display. (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
GAS VALVE FAULT	The Control has detected a problem with its gas valve output circuit.	Reset using manual reset screen on Control Display. (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 Boiler. Maintenance instructions should be carried out by the following guidelines.

- Maintenance procedures [Daily]

- **Check that the boiler casing is closed.**

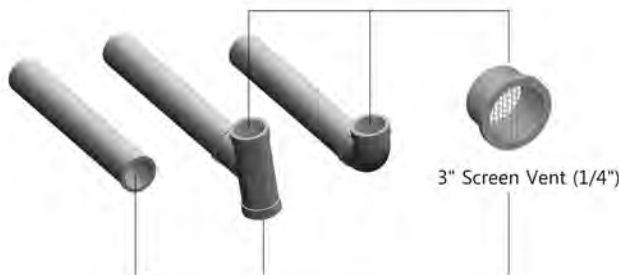
Check if there is any problem with the Boiler casing and the two upper and lower screws are tightened well. Boiler casing must be closed while it is running.

⚠ WARNING

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

⚠ WARNING

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



- **Check the power source.**

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

- **Check the status of the Control Display**

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 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 Boiler and system.

- **Check the condensate outlet.**

While the Boiler is running, check the discharge end of the condensate drain tubing.

Make sure that no flue gas is escaping from the condensate drain tubing.

If flue gas is continuously escaping, it is a serious problem. Call your qualified service technician for inspecting the Boiler and condensate line. Also, refill the condensate trap if problem persists regularly.

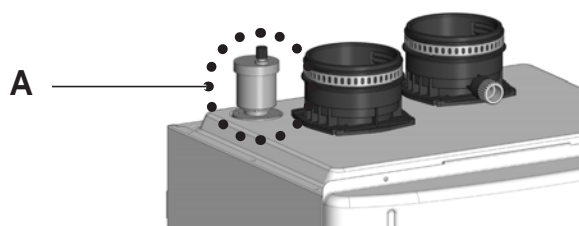
- **Check the vent terminal screen vent (rodent screen).**

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

8.1 Annual Startup & General Maintenance (continued)

- 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.



If water does not flow from the valve even though you have lifted the lever completely, the valve or discharge line may be blocked. Shut down the Boiler immediately. Call your qualified service technician to inspect the 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 an expert.

■ 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.

- Check the operate relief valve

⚠ WARNING

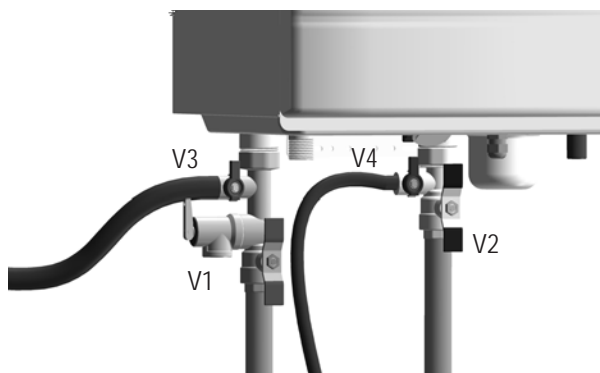
Leaks must be fixed by a qualified service technician immediately. Failure to comply with this instruction could result in severe personal injury, death or substantial property damage. This discharge line must be installed by a qualified heating installer or a service technician.

Before proceeding this startup procedure, verify that the 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.

8.2 Flushing the Boiler

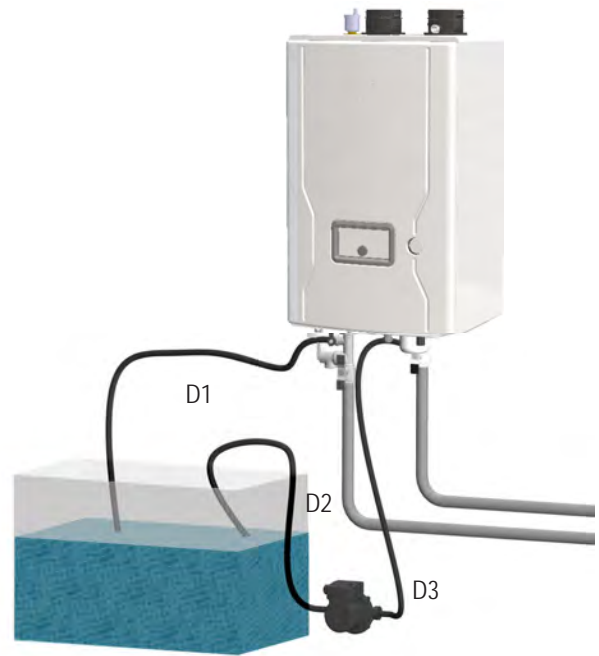
- Flushing the Boiler

Flushing the Heat Exchanger of boiler is a complicated procedure. Refer to the following instructions carefully before attempting the procedure. If you do not understand about the procedure, contact an authorized technician or licensed professional. Keep in mind that improper maintenance can void your warranty.



1. Disconnect electric power to the 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 boiler for at least 1 hour at a rate of 4 gallons per minute.)
7. Rinse the cleaning solution from the 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 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 boiler and clean out any residues.
11. Reinsert the filter and ensure the filter cap is securely tightened.
12. Connect electrical power to the boiler.



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.

⚠ NOTICE

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

⚠ 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%.

8.3 Freeze Protection (continued)

WARNING

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

Some items to consider are

- Consider the effects of reduced heat transfer and an increase in head pressure against the system circulator. For example: A 30% mixture of glycol will result in a BTU output loss of 15% with a 5% increase in head against the system circulator.
- Glycol mixtures should not exceed 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.

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

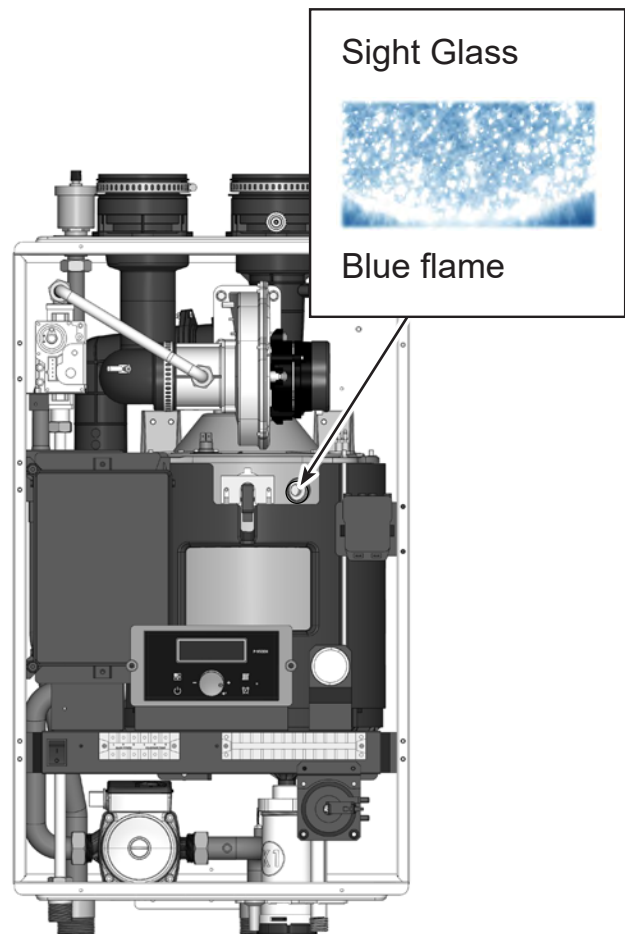
9.1 Quick View

- 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.
- 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?

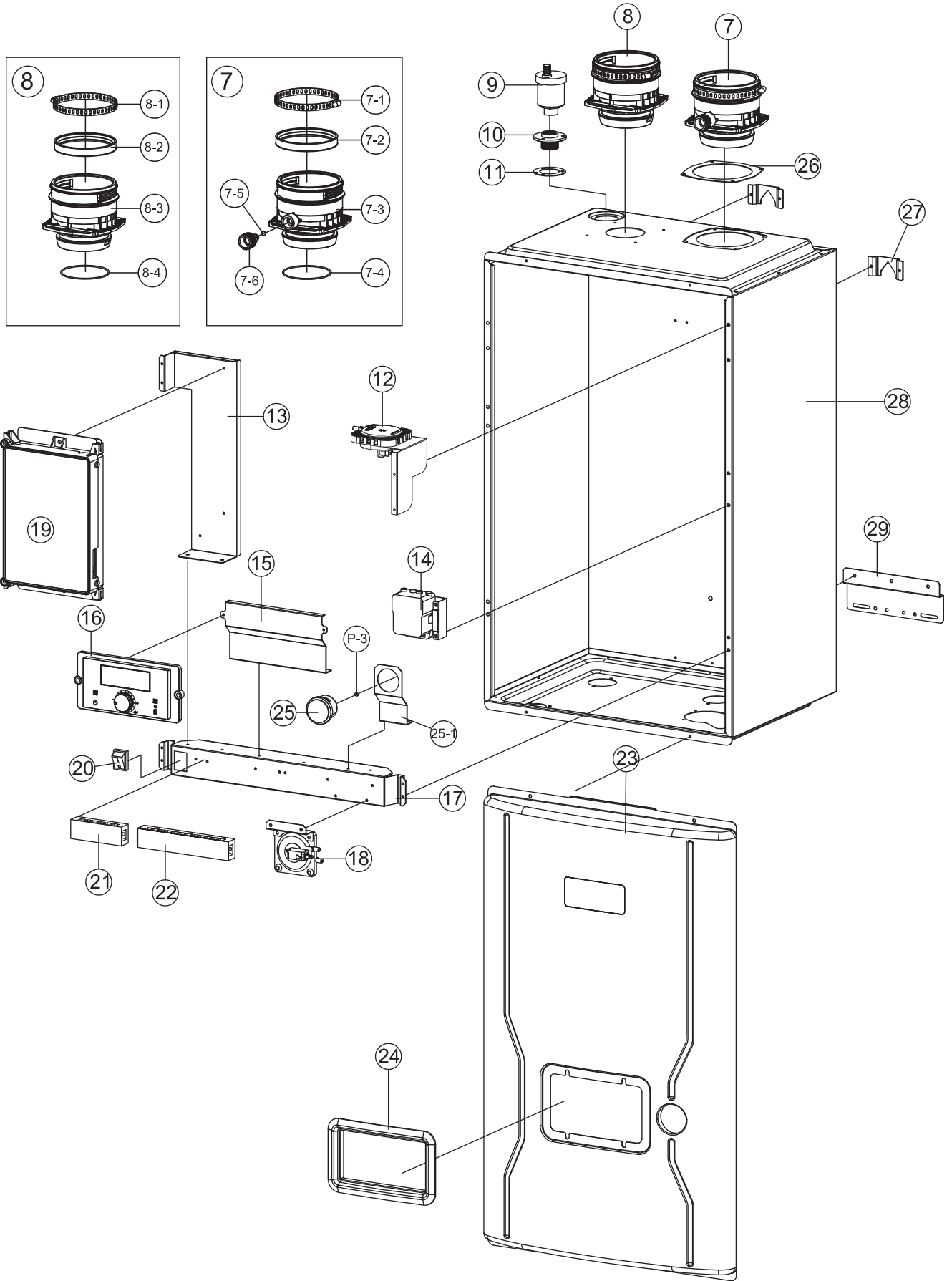
- Final check : Connecting the power supply
 - Please check that the power is 120V AC.
 - Have you checked the polarity of the electrical connection?
- Final check : Pressure relief valve
 - Have you properly installed an approved pressure relief valve on the boiler?
- Final check : Burner flames
 -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



SECTION 10 Parts

10.1 100 MBH

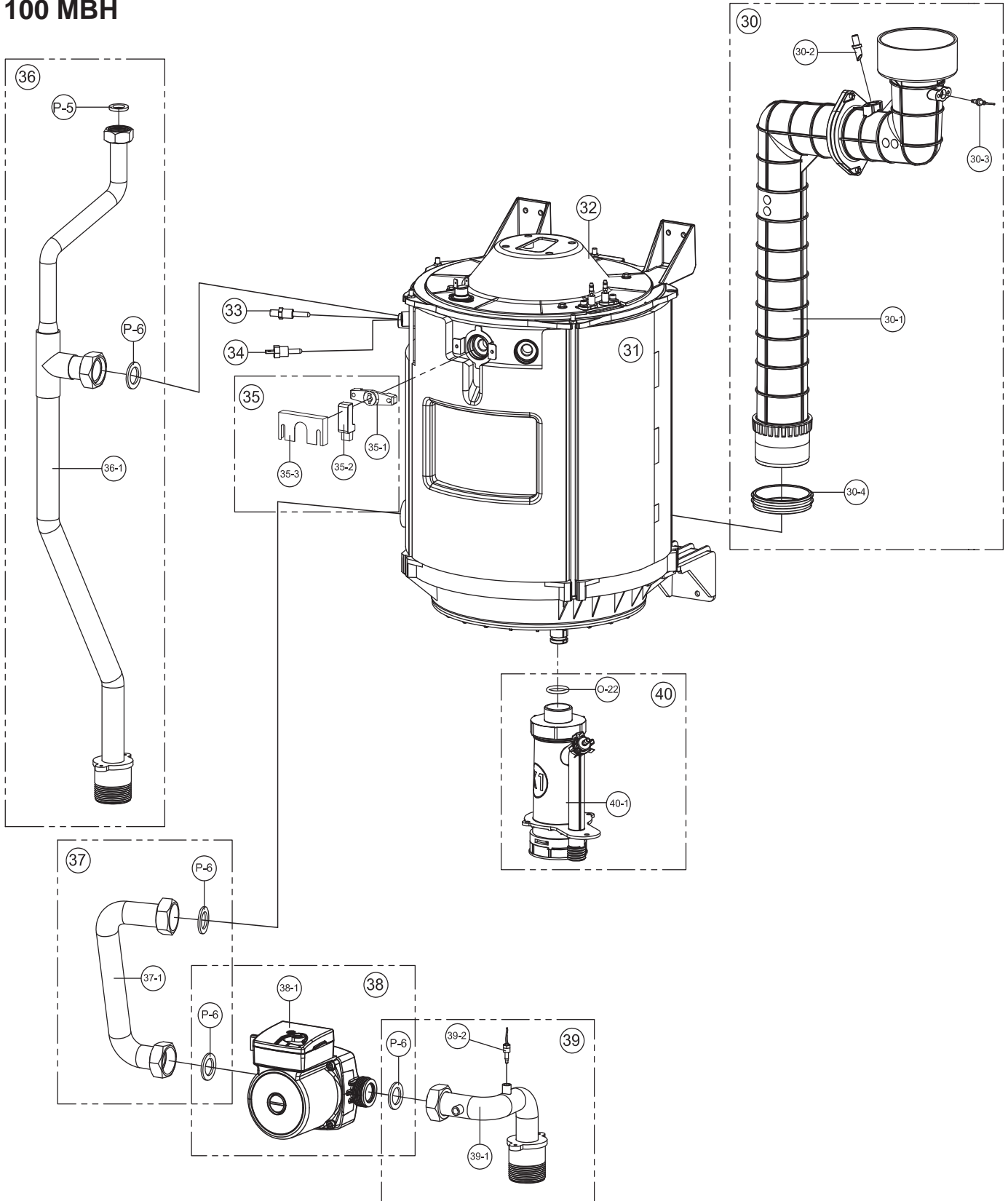
Casing Assembly



Casing Parts 100 MBH

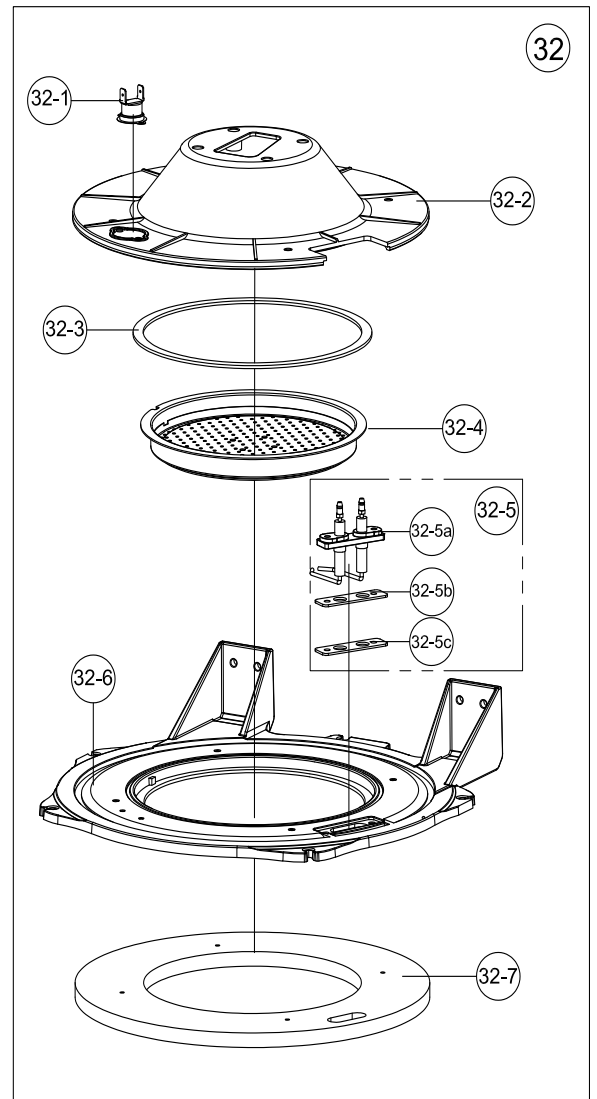
No.	Description	Part Number
P-3	3/8" Packing	FT1060
7	Exhaust vent duct assembly	FT2000
7-1	Stainless band (Ø100)	FT1603
7-2	Packing	FT1604
7-3	3 inch Exhaust vent duct	FT2001
7-4	O-Ring P75	FT1609
7-5	O-Ring P7	FT1601
7-6	Exhaust testing cap	FT1606
8	Air inlet duct assembly	FT2002
8-1	Stainless band (Ø100)	FT1603
8-2	Packing	FT1604
8-3	3 inch Air inlet vent duct	FT2003
8-4	O-Ring P75	FT1609
9	Air vent	FT1321
10	Air vent adaptor	FT1548
11	Air vent rubber pad	FT1939
12	Air pressure sensor (80)	FT1804
13	Control bracket	FT1049
14	Ignition transformer	ST1006
15	Display panel bracket	FT2004
16	Display panel	FT2050
17	Bracket	FT2006
18	Condensate blockage, air pressure switch	FT1022
19	PCB Control (NGTB-900CP)	FT1052
20	Power switch	FT1020
21	Terminal block (6P)	FT1827
22	Terminal block (12P)	FT1618
23	Front cover	FT2008
24	Display panel cover	FT2009
25	Pressure gauge	FT1058
25-1	Pressure gauge bracket	FT2010
26	Intake/Exhaust sealing pad	FT1771
27	Wall hung bracket (top)	FT1924
28	Casing assembly (100K)	FT2051
29	Wall hung bracket(bottom)	FT1936

Heat Exchanger Assembly 100 MBH

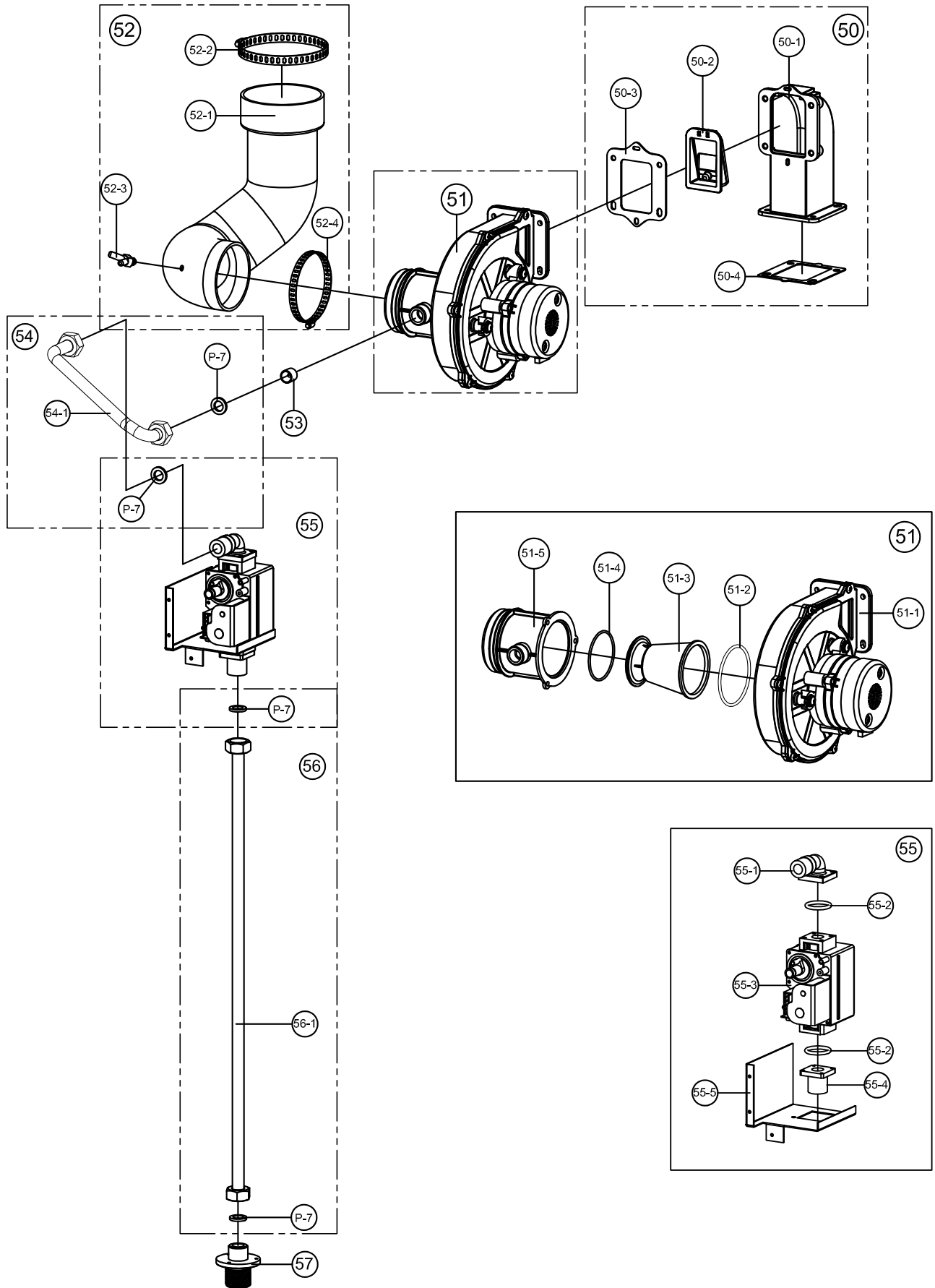


Heat Exchanger Parts 100 MBH

No.	Description	Part Number
30	Exhaust pipe assembly	FT2011
30-1	Exhaust pipe	FT2094
30-2	EX-Adaptor	FT1784
30-3	Exhaust overheat sensor	FT1307
30-4	Exhaust pipe packing (lower)	FT2012
31	Heat Exchanger assembly	FT2052
32	Burner assembly	FT2014
32-1	Overheat sensor	FT1310
32-2	Burner upper case	FT2048
32-3	Burner packing	FT1927
32-4	Burner	FT2015
32-5	Ignition rod assembly	FT2095
32-5a	Ignition rod	FT2016
32-5b	Ignition rod gasket	FT1316
32-5c	Ignitor ceramic paper	FT2017
32-6	Burner downside case	FT2049
32-7	Refractory	FT1665
33	Temperature sensor	FT1324
34	Low level sensor	FT1325
35	Flame detector sensor assembly	FT2096
35-1	Flame detector sensor bracket	FT1669
35-2	Flame detector sensor	FT1327
35-3	Flame detector sensor cover	FT1069
36	CH Outlet Pipe (100K) assembly	FT2138
36-1	CH Outlet Pipe (100K)	FT1853
P-5	3/4" Packing	FT1646
P-6	1" Packing	FT1691
37	CH Return Pipe-2 assembly	FT2098
37-1	CH Return Pipe-2	FT1072
P-6	1" Packing	FT1691
38	Pump assembly	FT2099
38-1	Pump	FT1672
P-6	1" Packing	FT1691
39	CH Return pipe-1 assembly	FT2100
39-1	CH Return pipe-1	FT1071
39-2	CH Return sensor	FT1635
P-6	1" Packing	FT1691
40	Condensate trap assembly	FT1783
O-22	O-Ring P22	FT1644



Blower Assembly 100 MBH



**Blower Parts
100 MBH**

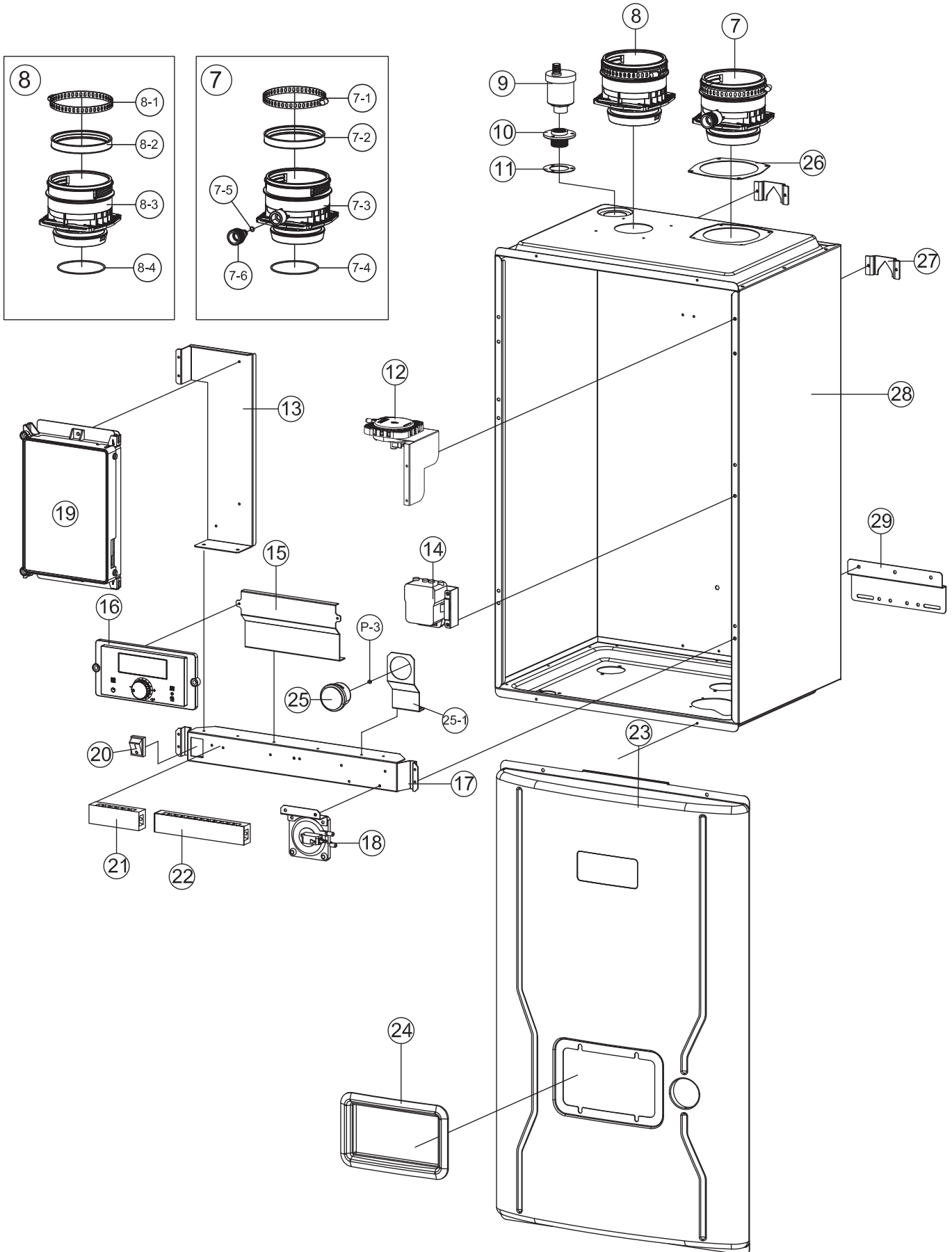
No.	Description	Part Number
50	Fan guide assembly	FT2101
50-1	Fan guide	FT2018
50-2	Damper body assembly	FT2019
50-3	Fan rubber packing #2	FT2020
50-4	Fan rubber packing(1.6t)	FT1082
51	Fan assembly	FT2053
51-1	Fan	FT1406
51-2	Fan sealing O-Ring	ST1038
51-3	AGM Venturi (Ø18)	FT2054
51-4	AGM O-Ring	FT1774
51-5	AGM Body	FT1775
52	Air intake hose (100K) assembly	FT2139
52-1	Air intake hose (100K)	FT2055
52-2	Stainless band (Ø100)	FT1603
52-3	Nylon Barb Y Fitting	FT1918
52-4	Stainless band (Ø89)	FT1777
53	Nozzle NG (Ø4.6)	FT2056
	Nozzle LP (Ø3.6)	FT2057
54	Gas pipe (upper/100K) assembly	FT2140
54-1	Gas pipe (upper/100K)	FT2058
P-7	1/2" Spiral packing	FT1710
55	Gas valve assembly	FT1413
55-1	Gas valve outlet adaptor	FT1919
55-2	Gas valve O-Ring	FT1727
55-3	Gas valve	FT1416
55-4	Gas valve inlet adaptor	FT1538
55-5	Gas valve bracket	FT1539
P-7	1/2" Spiral packing	FT1710
56	Gas pipe (down) assembly	FT2104
56-1	Gas pipe (down)	FT1086
P-7	1/2" Spiral packing	FT1710
57	Gas inlet adaptor	FT1893

Optional Items

No.	Description	Part Number
100	Pressure relief valve	FT1500
101	Outdoor temperature sensor	FT1501
102	Bird screen 3"	FT1730
104	Spare parts kit	FT2059
105	Condensate hose	ST1070
106	Wall hung bracket	FT1894
112	Wire harness	FT1905
113	Gas conversion kit	FT2064

10.2 140 MBH

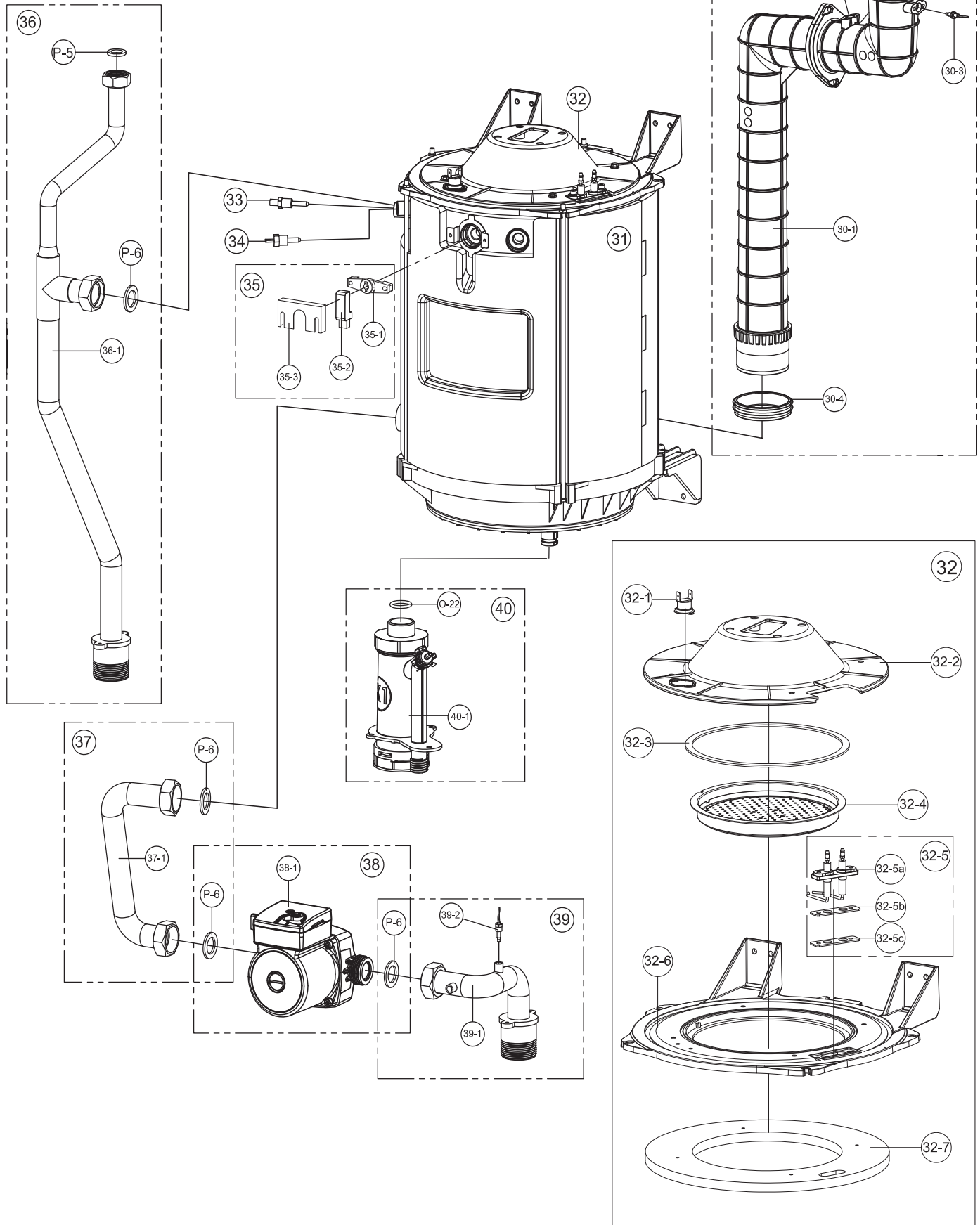
Casing Assembly



Casing Parts 140 MBH

No.	Description	Part Number
P-3	3/8" Packing	FT1060
7	Exhaust vent duct assembly	FT2000
7-1	Stainless band (Ø100)	FT1603
7-2	Packing	FT1604
7-3	3 inch Exhaust vent duct	FT2001
7-4	O-Ring P75	FT1609
7-5	O-Ring P7	FT1601
7-6	Exhaust testing cap	FT1606
8	Air inlet duct assembly	FT2002
8-1	Stainless band (Ø100)	FT1603
8-2	Packing	FT1604
8-3	3 inch Air inlet vent duct	FT2003
8-4	O-Ring P75	FT1609
9	Air vent	FT1321
10	Air vent adaptor	FT1548
11	Air vent rubber pad	FT1939
12	Air pressure sensor (80)	FT1804
13	Control bracket	FT1049
14	Ignition transformer	ST1006
15	Display panel bracket	FT2004
16	Display panel	FT2050
17	Bracket	FT2006
18	Condensate blockage, air pressure switch	FT1022
19	PCB Control (NGTB-900CP)	FT1052
20	Power switch	FT1020
21	Terminal block (6P)	FT1827
22	Terminal block (12P)	FT1618
23	Front cover	FT2008
24	Display panel cover	FT2009
25	Pressure gauge	FT1058
25-1	Pressure gauge bracket	FT2010
26	Intake/Exhaust sealing pad	FT1771
27	Wall hung bracket (top)	FT1924
28	Casing assembly (120,140K)	FT2061
29	Wall hung bracket (bottom)	FT1936

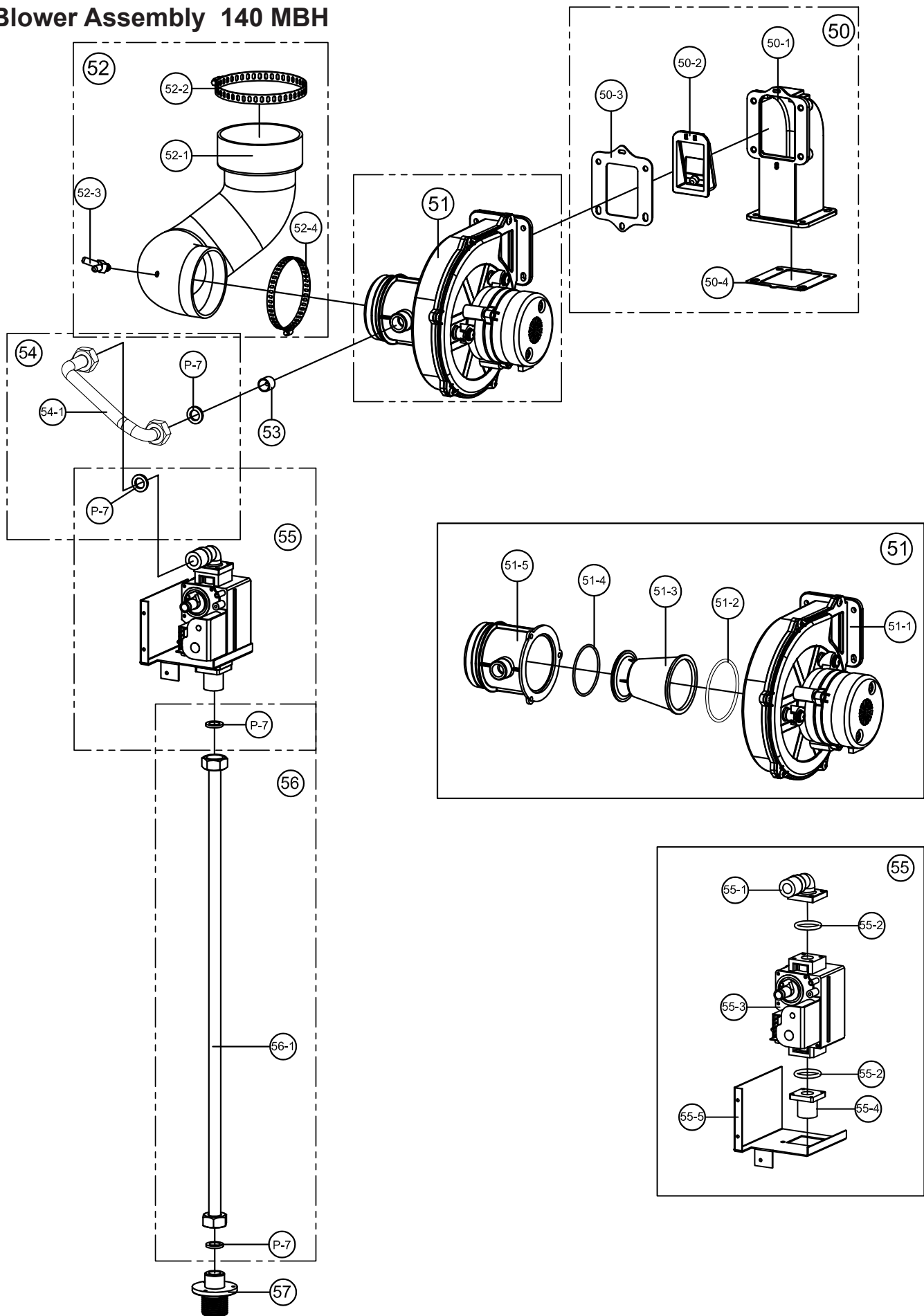
Heat Exchanger Assembly 140 MBH



Heat Exchanger Parts 140 MBH

No.	Description	Part Number
30	Exhaust pipe assembly	FT2011
30-1	Exhaust pipe	FT2094
30-2	EX-Adaptor	FT1784
30-3	Exhaust overheat sensor	FT1307
30-4	Exhaust pipe packing (lower)	FT2012
31	Heat exchanger assembly	FT2062
32	Burner assembly	FT2014
32-1	Overheat sensor	FT1310
32-2	Burner upper case	FT2048
32-3	Burner packing	FT1927
32-4	Burner	FT2015
32-5	Ignition Rod assembly	FT2095
32-5a	Ignition rod	FT2016
32-5b	Ignition rod gasket	FT1316
32-5c	Ignitor ceramic paper	FT2017
32-6	Burner downside case	FT2049
32-7	Refractory	FT1665
33	Temperature sensor	FT1324
34	Low level sensor	FT1325
35	Flame detector sensor assembly	FT2096
35-1	Flame detector sensor bracket	FT1669
35-2	Flame detector sensor	FT1327
35-3	Flame detector sensor cover	FT1069
36	CH Outlet Pipe (140K) assembly	FT2097
36-1	CH Outlet Pipe (140K)	FT1070
P-5	3/4" Packing	FT1646
P-6	1" Packing	FT1691
37	CH Return Pipe-2 assembly	FT2098
37-1	CH Return Pipe-2	FT1072
P-6	1" Packing	FT1691
38	Pump assembly	FT2099
38-1	Pump	FT1672
P-6	1" Packing	FT1691
39	CH Return pipe-1 assembly	FT2100
39-1	CH Return pipe-1	FT1071
39-2	CH Return sensor	FT1635
P-6	1" Packing	FT1691
40	Condensate trap assembly	FT2086
40-1	Condensate trap	FT1783
O-22	O-Ring P22	FT1644

Blower Assembly 140 MBH



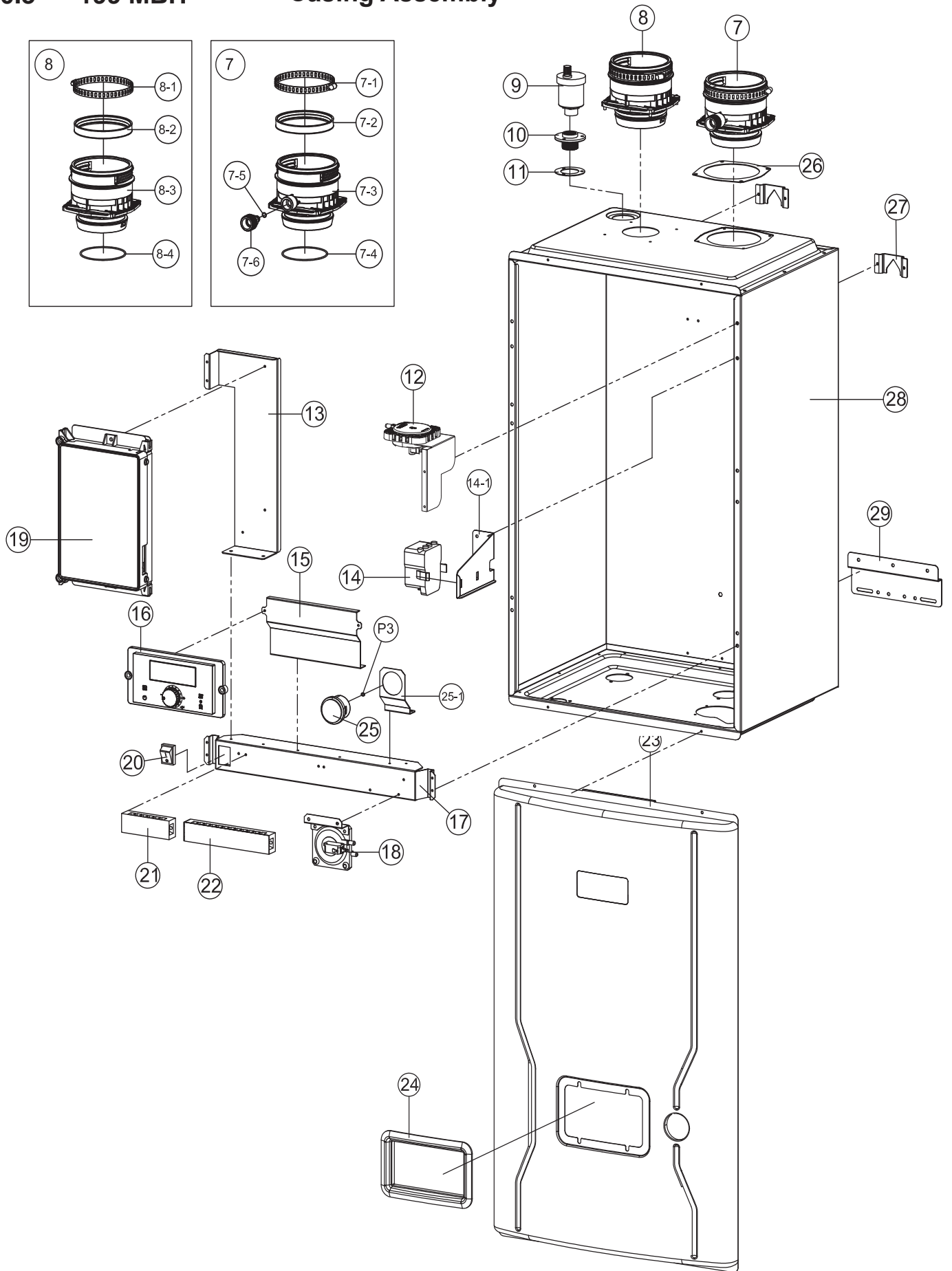
Blower Parts 140 MBH

No.	Description	Part Number
50	Fan guide assembly	FT2101
50-1	Fan guide	FT2018
50-2	Damper body assembly	FT2019
50-3	Fan rubber packing #2	FT2020
50-4	Fan rubber packing (1.6t)	FT1082
51	Fan assembly	FT2021
51-1	Fan	FT1406
51-2	Fan sealing O-Ring	ST1038
51-3	AGM Venturi (Ø23)	FT2022
51-4	AGM O-Ring	FT2023
51-5	AGM Body	FT2024
52	Air intake hose (140K) assembly	FT2102
52-1	Air intake hose (140K)	FT2026
52-2	Stainless band (Ø100)	FT1603
52-3	Nylon Barb Y Fitting	FT1918
52-4	Stainless band (Ø89)	FT1777
53	Nozzle NG (Ø6.2)	FT2027
	Nozzle LP (Ø4.7)	FT2028
54	Gas pipe (upper/140K) assembly	FT2103
54-1	Gas pipe (upper/140K)	FT2063
P-7	1/2" Spiral packing	FT1710
55	Gas valve assembly	FT1413
55-1	Gas valve outlet adaptor	FT1919
55-2	Gas valve O-Ring	FT1727
55-3	Gas valve	FT1416
55-4	Gas valve inlet adaptor	FT1538
55-5	Gas valve bracket	FT1539
P-7	1/2" Spiral packing	FT1710
56	Gas pipe (down) assembly	FT2104
56-1	Gas pipe (down)	FT1086
P-7	1/2" Spiral packing	FT1710
57	Gas inlet adaptor	FT1893

Optional Items

No.	Description	Part Number
100	Pressure relief valve	FT1500
101	Outdoor temperature sensor	FT1501
102	Bird screen 3"	FT1730
104	Spare parts kit	FT2059
105	Condensate hose	ST1070
106	Wall hung bracket	FT1894
112	Wire harness	FT1905
113	Gas conversion kit	FT2064

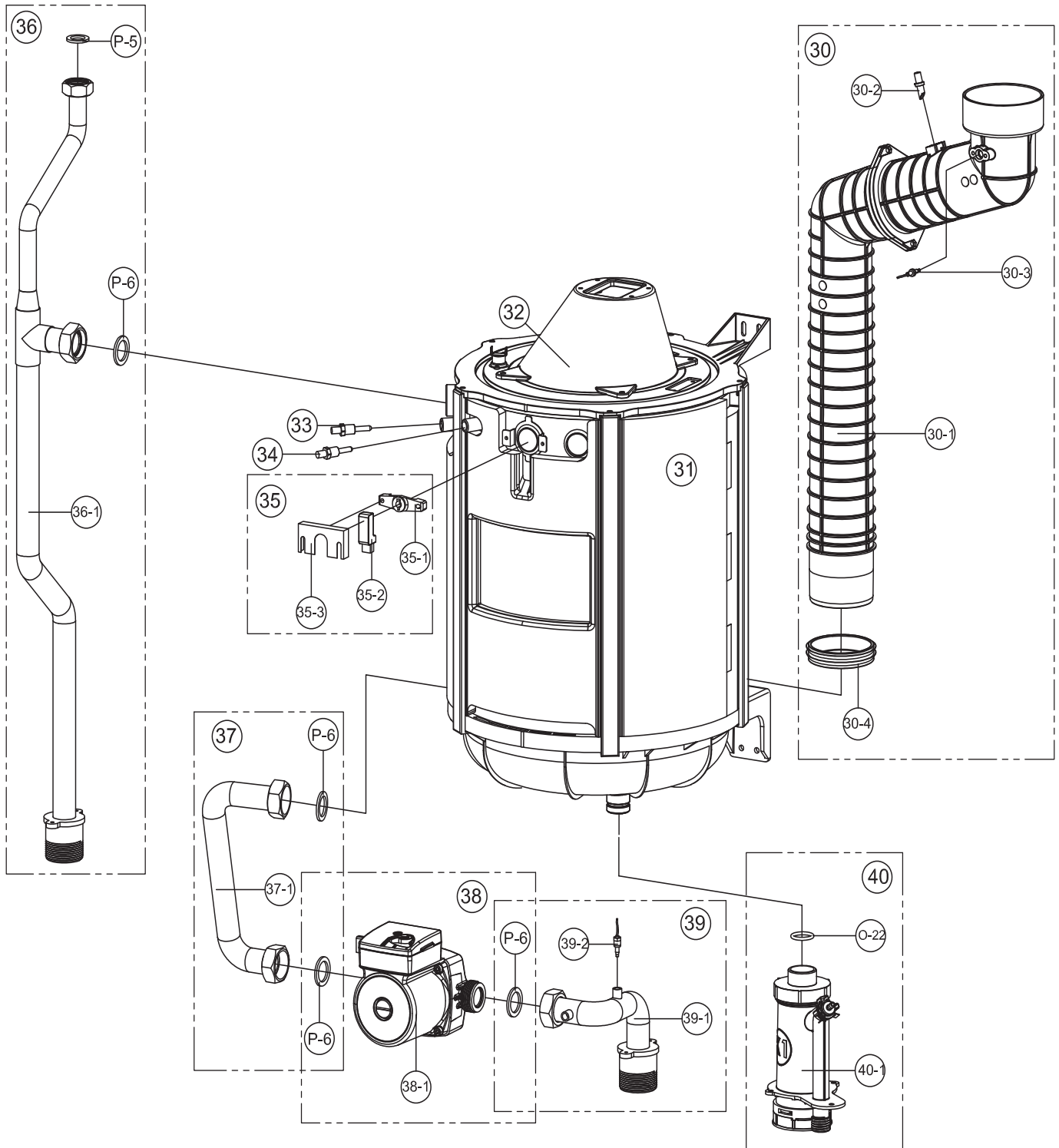
10.3 199 MBH Casing Assembly



Casing Parts 199 MBH

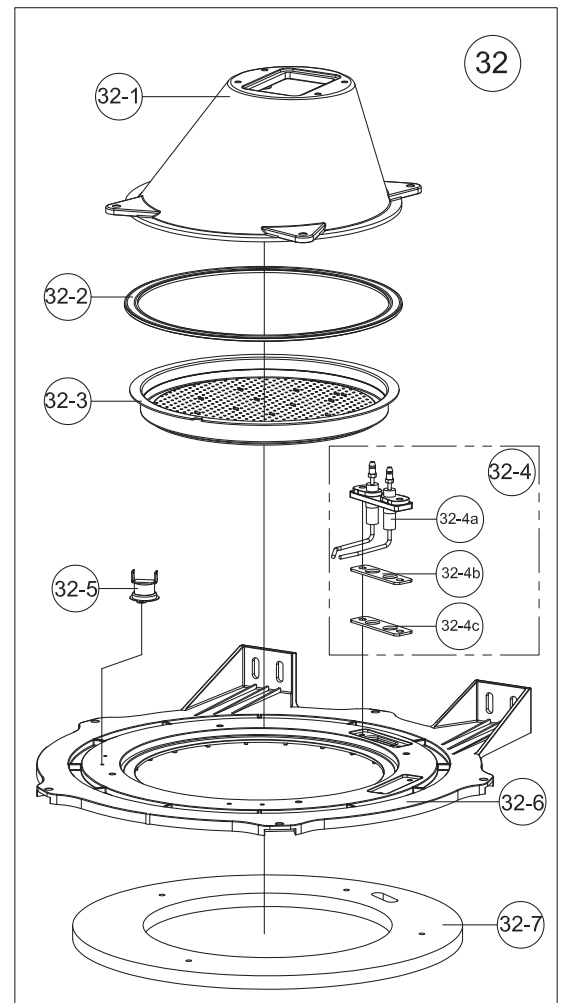
No.	Description	Part Number
P-3	3/8" Packing	FT1060
7	Exhaust vent duct assembly	FT2000
7-1	Stainless band (Ø100)	FT1603
7-2	Packing	FT1604
7-3	3 inch Exhaust vent duct	FT2001
7-4	O-Ring P75	FT1609
7-5	O-Ring P7	FT1601
7-6	Exhaust testing cap	FT1606
8	Air inlet duct assembly	FT2002
8-1	Stainless band (Ø100)	FT1603
8-2	Packing	FT1604
8-3	3 inch Air inlet vent duct	FT2003
8-4	O-Ring P75	FT1609
9	Air vent	FT1321
10	Air vent adaptor	FT1548
11	Air vent rubber pad	FT1939
12	Air pressure sensor (80)	FT1804
13	Control bracket	FT1751
14	Ignition transformer	FT2031
14-1	Ignition transformer bracket	FT2032
15	Control sub-bracket	FT2033
16	Display Control	FT2050
17	Bracket	FT1753
18	Condensate blockage, air pressure switch	FT1022
19	PCB Control (NGTB-900CP)	FT1052
20	Power switch	FT1020
21	Terminal block (6P)	FT1827
22	Terminal block (12P)	FT1618
23	Front cover	FT2034
24	Display panel cover	FT2009
25	Pressure gauge	FT1058
25-1	Pressure gauge bracket	FT2065
26	Intake/Exhaust sealing pad	FT1771
27	Wall hung bracket (top)	FT1924
28	Casing assembly (199K)	FT2066
29	Wall hung bracket (bottom)	FT1936

Heat Exchanger Assembly (199 MBH)

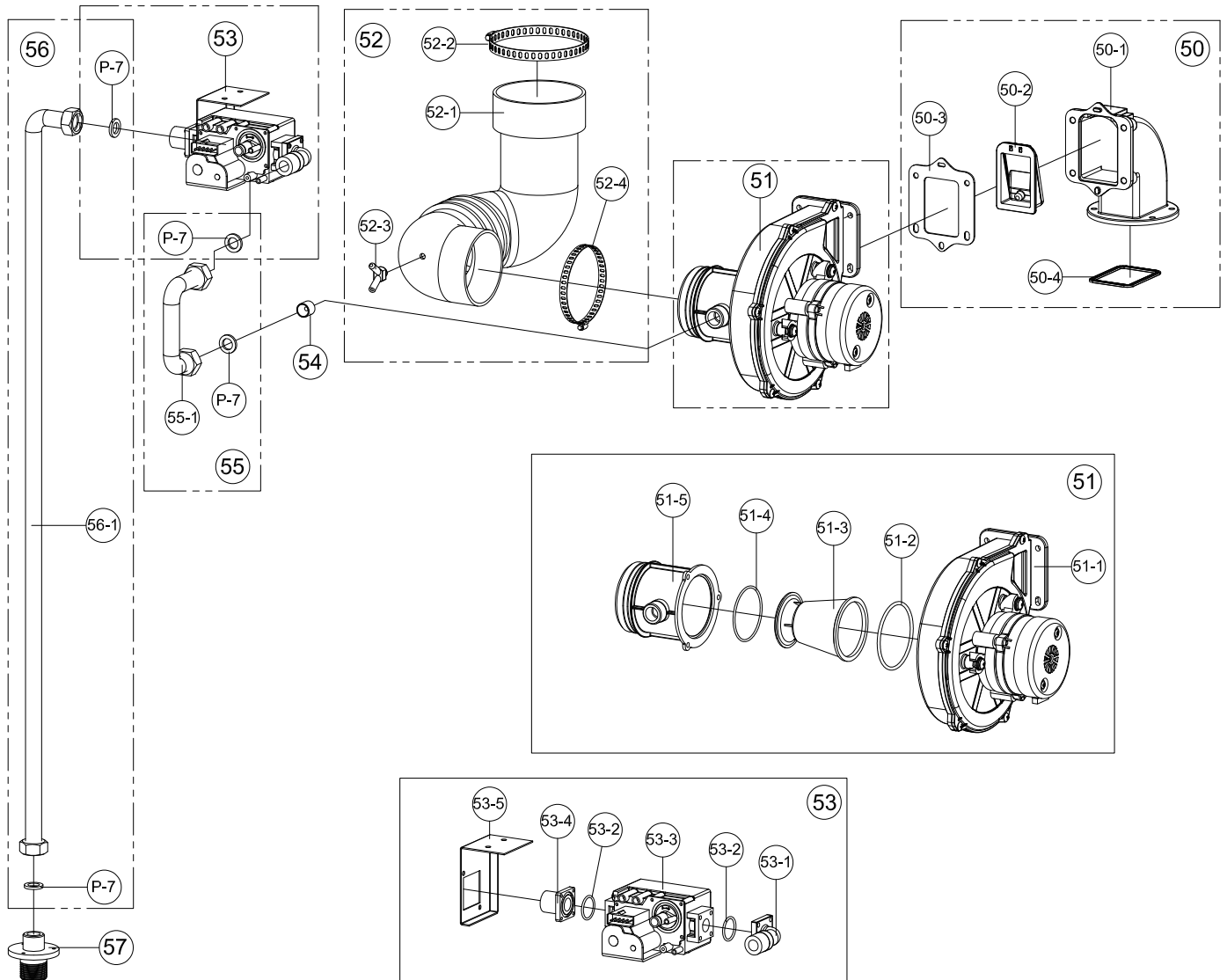


Heat Exchanger Parts (199 MBH)

No.	Description	Part Number
30	Exhaust pipe assembly	FT2035
30-1	Exhaust pipe	FT2125
30-2	EX-Adaptor	FT1784
30-3	Exhaust overheat sensor	FT1307
30-4	Exhaust pipe packing (lower)	FT2036
31	Heat Exchanger assembly	FT2067
32	Burner assembly	FT2038
32-1	Burner upper case	FT1760
32-2	Burner gasket	FT1824
32-3	Burner	FT2039
32-4	Ignition rod assembly	FT2128
32-4a	Ignition rod	FT2040
32-4b	Ignition rod gasket	FT1316
32-4c	Ignitor ceramic paper	FT2017
32-5	Overheat sensor	FT1310
32-6	Burner downside case	FT2041
32-7	Refractory	FT2042
33	Temperature sensor	FT1324
34	Low level sensor	FT1325
35	Flame detector sensor assembly	FT2129
35-1	Flame detector sensor bracket	FT1669
35-2	Flame detector sensor	FT1327
35-3	Flame detector sensor cover	FT1069
36	CH Outlet (Supply) Pipe(199K) assembly	FT2130
36-1	CH Outlet (Supply) Pipe (199K)	FT1765
P-5	3/4" Packing	FT1646
P-6	1" Packing	FT1691
37	CH Return Pipe-2 assembly	FT2131
37-1	CH Return Pipe-2	FT1768
P-6	1" Packing	FT1691
38	Pump assembly	FT2132
38-1	Pump	FT1767
P-6	1" Packing	FT1691
39	CH Return pipe-1 assembly	FT2133
39-1	CH Return pipe-1	FT1071
39-2	CH Return sensor	FT1635
P-6	1" Packing	FT1691
40	Condensate trap assembly	FT1783
O-22	O-ring P22	FT1514



Blower Assembly (199 MBH)



Blower Parts (199 MBH)

No.	Description	Part Number
50	Fan guide assembly	FT2134
50-1	Fan guide	FT2043
50-2	Damper body assembly	FT2044
50-3	Fan rubber packing #2	FT2020
50-4	Fan guide packing	FT1772
51	Fan assembly	FT1916
51-1	Fan	FT1406
51-2	Fan sealing O-Ring	ST1038
51-3	AGM Venturi	FT1917
51-4	AGM O-Ring	FT1774
51-5	AGM Body	FT1775
52	Air intake hose assembly	FT2135
52-1	Air intake hose	FT1776
52-2	Stainless band (Ø100)	FT1603
52-3	Nylon Barb Y Fitting	FT1918
52-4	Stainless band (Ø89)	FT1777
53	Gas valve assembly	FT1950
53-1	Gas valve outlet adaptor	FT1919
53-2	Gas valve O-ring	FT1415
53-3	Gas valve	FT1416
53-4	Gas valve inlet adaptor	FT1538
53-5	Gas valve bracket	FT1779
P-7	1/2" Spiral packing	FT1710
54	Nozzle (natural)	FT1780
	Nozzle (propane)	FT1802
55	Gas pipe (upper) assembly	FT2136
55-1	Gas pipe (upper)	FT1781
P-7	1/2" Spiral packing	FT1710
56	Gas pipe(down) assembly	FT2137
56-1	Gas pipe (down)	FT1782
P-7	1/2" Spiral packing	FT1710
57	Gas inlet adaptor	FT1087

Optional Items

No.	Description	Part Number
100	Pressure relief valve	FT1500
101	Outdoor temperature sensor	FT1501
102	Bird screen 3"	FT1730
104	Spare parts kit	FT2059
105	Condensate hose	ST1070
106	Wall hung bracket	FT1894
107	Wire harness	FT1906
108	Gas conversion kit	FT2068

