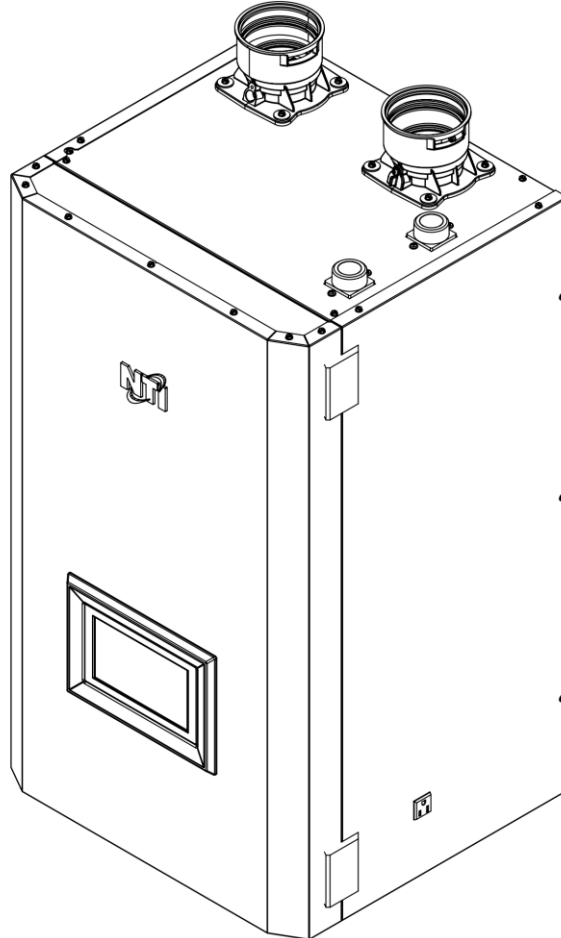


# TFTN 085-399

## INSTALLATION AND OPERATION MANUAL

Version Date: 2023-11-28

Update: 285-399 Throttle Screw adjustment; Cascade with Upstream IWH (Cascade Pump) [require SW v00.26.01 or greater]; Buffer Tank & DHW Recirc application examples; 112 1 error code description



### HAZARD SYMBOLS AND DEFINITIONS



Danger Sign: Indicates a hazardous situation which, if not avoided, will result in serious injury or death.



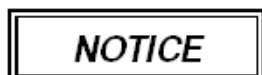
Warning Sign: Indicates a hazardous situation which, if not avoided, could result in serious injury or death.



Caution Sign plus Safety Alert Symbol: Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Caution Sign without Safety Alert Symbol: Indicates a hazardous situation which, if not avoided, could result in property damage.



Notice Sign: Indicates a hazardous situation which, if not avoided, could result in property damage.



This Boiler must be installed by a licensed and trained Heating Technician, or the **Warranty is Void**. Failure to properly install this unit may result in property damage, serious injury to occupants, or possibly death.

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**Read Before Proceeding****WARNING**

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, serious injury or death.

**FOR YOUR SAFETY, READ BEFORE OPERATING**

- A) This boiler does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B) BEFORE OPERATING smell all around the boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.  
WHAT TO DO IF YOU SMELL GAS:
  - Do not try to light any boiler.
  - Do not touch any electric switch.
  - Do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- C) Use only your hand to turn the gas "shutoff" valve. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D) Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control which has been under water.

**OPERATING INSTRUCTIONS**

1. STOP! Read the safety information above very carefully.
2. Set the thermostat to lowest setting. Turn off all electric power to the boiler.
3. This boiler does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
4. Turn the manual gas valve to the OFF position. Remove front access panel.
5. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above. If you don't smell gas, go to the next step.
6. Turn the manual gas valve ON. Wait an additional five (5) minutes smelling for gas.
7. Replace the front access panel.
8. Set thermostat to highest setting. Turn on all electric power to the boiler.
9. Ignition sequence is automatic. Combustion will occur after a brief fan purge.
10. If ignition does not occur, follow the instructions "To Turn Off Gas To Boiler" and call your service technician or gas supplier.

**TO TURN OFF GAS TO THE BOILER**

1. STOP! Read the safety information above very carefully.
2. Turn off all electric power to the boiler.
3. Turn the manual gas valve to the OFF position.

**WARNING**

**Crystalline Silica** – Certain components confined in the combustion chamber may contain this potential carcinogen. Improper installation, adjustment, alteration, service, or maintenance can cause property damage, serious injury (exposure to hazardous materials) or death. Refer to [15.0 ANNUAL MAINTENANCE AND INSPECTION](#) for information on handling instructions and recommended personal protective equipment. Installation and service must be performed by a qualified installer, service agency or the gas supplier (who must read and follow the supplied instructions before installing, servicing, or removing this boiler. This boiler contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans).

**WARNING**

**Void Warranty** – This Boiler must have water flowing through it whenever the burner is on, or it will damage the unit and void the warranty. Failure to follow these instructions may result in serious injury or death.

## 1.0 INTRODUCTION

### 1.1 General Installation Requirements

The installation of your NTI TFTN gas-fired boiler must conform to the requirements of this manual, your local authority, and the National Fuel Gas Code ANSI Z223.1 and or CAN/CGA B149 Installation Codes. Where required by the Authority, the installation must conform to the standard for “Controls and Safety Devices for Automatically Fired Boilers ANSI/ASME CSD-1.

This document pertains to the correct installation and operation of NTI boiler models TFTN085, TFTN110, TFTN150 & TFTN199. The instructions detailed in this document supersede any and all previous instructions provided by NTI, written or otherwise. Each unit is provided with the following documentation:

1. Installation and Operation Manual (this document)
2. Warranty Terms and Conditions
3. User Information Manual, and
4. Natural Gas to LP Conversion Kit\*

\* The conversion kit is required to convert the boiler so it will safely operate with Propane Gas.



Read and understand this entire document prior to proceeding with the installation of the TFTN boiler. Failure to follow the instructions outlined in this document will result in property damage, serious injury or death.



**Energy Saving Feature** - This boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function. **THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:**

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

### 1.2 User Responsibilities

This boiler must be installed and serviced by a qualified installer or service technician. This boiler must be serviced and inspected annually when operating in normal residential applications. Demanding applications or extreme conditions (i.e., commercial) may require more frequent service and inspection. As the User/Owner of this equipment, you are responsible for ensuring the maintenance is performed at the required intervals; see section [15.0 ANNUAL MAINTENANCE AND INSPECTION](#).



Failure to have the boiler properly serviced and inspected on a regular basis by a qualified service technician may result in property damage, serious injury or death.



Failure to keep the Exhaust and Combustion Air Intake clear of ice, snow, and other debris may result in property damage, serious injury, or death.

### 1.3 Installer Responsibilities

As the installing technician it is your responsibility to ensure the installation is performed in accordance with this instruction manual as well as any applicable local or National installation codes. It is also your responsibility to inform the User/Owner of the “[User Responsibilities](#)”. Failure to follow this warning could result in fire, serious injury, or death.

### 1.4 Before Operating with Propane



TFTN boilers are factory set to operate with Natural Gas; **BEFORE OPERATING WITH PROPANE**, the boiler must be converted using the appropriate *Natural Gas to LP Conversion Kit*; see below. Failure to properly convert the unit to safely operate with Propane will cause dangerous burner operation, resulting in property damage, serious injury or death.

Table 1-1 Natural Gas to LP Conversion Kits

Boiler Model	Natural Gas to LP Conversion Kit (part no.)
TFTN085-110	87752
TFTN150	87753
TFTN199	87740
TFTN285	87754
TFTN340-399	87755

**Notes:**

1. TFTN085-199 models are converted to Propane using a replacement LP-Mixer and Diaphragm insert, which are provided in the respective Natural Gas to LP Conversion Kit; follow the instructions provided in the kit to complete the conversion to LP.
2. TFTN285-399 models are converted to Propane by installing an LP-Orifice, which is provided in the respective Natural Gas to LP Conversion Kit; follow the instructions provided in the kit to complete the conversion to LP.



Liquefied Petroleum (LP) propane gas is heavier than air. Do not install the boiler in a pit or similar location that will permit heavier than air gas to collect. Check with Local Codes as they may require boilers fueled with LP gas to be provided with an approved means of removing unburned gases from the room. Failure to follow these instructions may result in serious injury or death.

### 1.5 Boiler Exhaust / Air-Intake Vent Piping



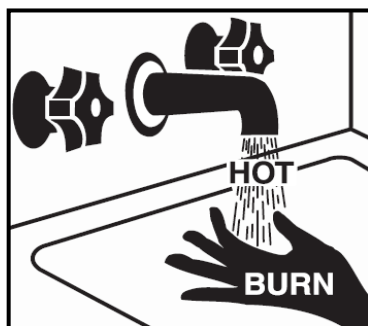
The TFTN is certified as a “Category IV” boiler and requires a “Special Venting System” designed for pressurized venting. The exhaust gases must be piped directly to the outdoors using the vent materials and rules outlined in these instructions. Failure to follow these instructions will result in serious injury or death.

### 1.6 DHW Temperature Adjustment and Scalding

This boiler, when connected to an Indirect Water Heater (IWH) can deliver scalding water. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased water temperatures. By setting the thermostat on this boiler to obtain the increased water temperature required by these appliances you may create the potential for scald injury.

To protect against injury, install a mixing valve in the water system. This valve will reduce point of use discharge temperatures by mixing cold and hot water in branch supply lines. Such valves are available from your local plumbing supplier.

Table 1-2 details the relationship of water temperature and time regarding scald injury and may be used as a guide in determining the safest water temperature for your applications.



120°F	More than 5 minutes
125°F	1.5 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1.5 seconds
155°F	About 1 second

## 1.7 In the State of Massachusetts

- (a) For all horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned and operated by the Commonwealth and where 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, the following requirements shall be satisfied:
1. **INSTALLATION OF CARBON MONOXIDE DETECTORS** At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gas fitter shall observe that a hard-wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed and on each additional level of the dwelling, building or structure served by the equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the 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 detector with alarm and battery back-up may be installed on the next adjacent floor level.
    - b. In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of 30 days to comply with the above requirements; provided, however, that during said 30-day period a battery operated carbon monoxide detector with an alarm shall be installed.
  2. **APPROVED CARBON MONOXIDE DETECTORS** Each carbon monoxide detector as required in accordance with the above provisions 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 the horizontally vented gas fueled heating boiler or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "***GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS***" (*plate included with boiler*).
  4. **INSPECTION** The state or local gas inspector of the side wall horizontally vented gas fueled equipment 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 through 4.
- (b) **EXEMPTIONS:** The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:
1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
  2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.
- (c) **MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM PROVIDED:** When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:
1. Detailed instructions for installation of the venting system design or the venting system components; and
  2. A complete parts list for the venting system design or venting system.
- (d) **MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED:** When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:
1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
  2. The "special venting system" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.
- (e) A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts list for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

## 2.0 SPECIFICATIONS

Table 2-1 Specifications

DESCRIPTION	TFTN085	TFTN110	TFTN150	TFTN199	TFTN285	TFTN340	TFTN399
CSA Input Modulation [MBH] <sup>1</sup>	8.5 - 85	11 - 110	15 - 150	19.9 - 199	28.5 - 285	39.9 - 340	39.9 - 399
Heating Capacity [MBH] <sup>1,2</sup>	79	101	138	184	263	324	380
Net AHRI Rating, Water [MBH] <sup>1,2</sup>	69	88	120	160	229	282	330
AFUE [%] <sup>2</sup>	96	95	95	95	95	95.4	95.4
Water Connections, NPT [in.]	1-1/4 (M)	1-1/4 (M)	1-1/4 (M)	1-1/4 (M)	1-1/4 (M)	1-1/2 (M)	1-1/2 (M)
Gas Connection, NPT [in.]	3/4 (M)	3/4 (M)	3/4 (M)	3/4 (M)	3/4 (M)	3/4 (M)	3/4 (M)
Vent/Air-inlet Pipe Diameter [in.] <sup>3</sup>	2 or 3	2 or 3	2 or 3	2 or 3	3	4	4
Cabinet Height [in.]	34-1/8	34-1/8	34-1/8	34-1/8	34-1/8	36-1/2	36-1/2
Cabinet Width [in.]	19-7/8	19-7/8	19-7/8	19-7/8	21-3/8	25-1/4	25-1/4
Cabinet Depth [in.]	17-1/4	17-1/4	18-3/4	18-3/4	18-3/8	18-7/8	21-1/4
Approx. Boiler Weight with Water [lbs]	107	107	122	140	180	250	250
Approx. Boiler Water Content [Gallons]	1.4	1.4	2.0	2.8	4.9	7.1	6.4
Electrical Rating	120V / 1Ph / 60Hz / less than 12A						
<b>Notes:</b>							
1. Listed Input and Output ratings are at minimum vent lengths at an altitude of 0-2000ft. Numbers will be lower with longer venting and/or altitudes greater than 2000ft.							
2. Ratings based on standard test procedures prescribed by the U.S. Department of Energy; certified by AHRI. Efficiency listed for models TFTN340 & TFTN399 represents Thermal Efficiency (AFUE is not applicable).							
3. TFTN units require a special venting system, use only vent materials and methods detailed in these instructions.							

### 2.1 High Altitude Operation

The TFTN is designed to operate at its maximum listed capacity in installations located at 0-2000ft above Sea Level. Since the density of air decreases as elevation increases, maximum specified capacity should be de-rated for elevations above 2000 ft [610 m] in accordance with Table 2-2.

Table 2-2 De-rate % for High Altitudes

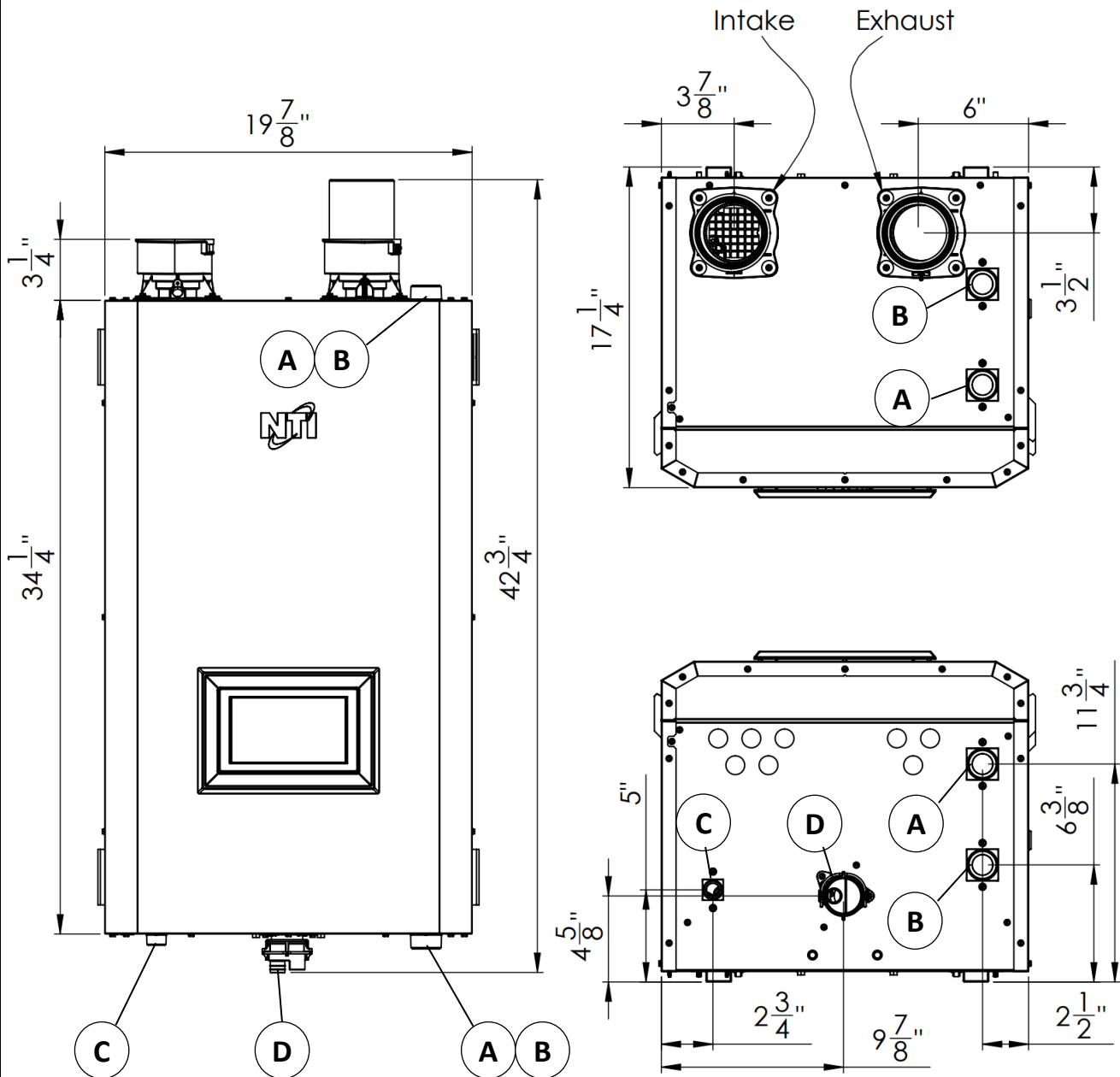
Elevations	2001 ft.	3000 ft.	4000 ft.	4500 ft.	5000 ft.
In Canada <sup>1</sup>	de-rate by 10%	de-rate by 10%	de-rate by 10%	de-rate by 10%	de-rate % may vary
In USA <sup>2</sup>	-	de-rate by 12%	de-rate by 16%	de-rate by 18%	de-rate by 20%
<b>Notes:</b>					
<sup>1</sup> Canada: Altitudes between 2000-4500 ft., de-rate by 10%. Consult local authorities for de-rating capacities for altitudes above 4500 ft.					
<sup>2</sup> USA: De-rate capacity by 4% for every 1000 ft [305 m], if altitude is above 2000 ft.					



**Combustion** – At elevations above 2000 feet, the combustion of the boiler must be checked with a calibrated combustion analyzer to ensure safe and reliable operation. It is the Installers responsibility to check the combustion and to adjust the combustion in accordance with section [9.0 GAS VALVE AND BURNER SET-UP](#). Failure to follow these instructions may result in property damage, serious injury, or death.

2.2 Dimensions

Figure 2-1 Boiler Dimension (TFTN085-110)

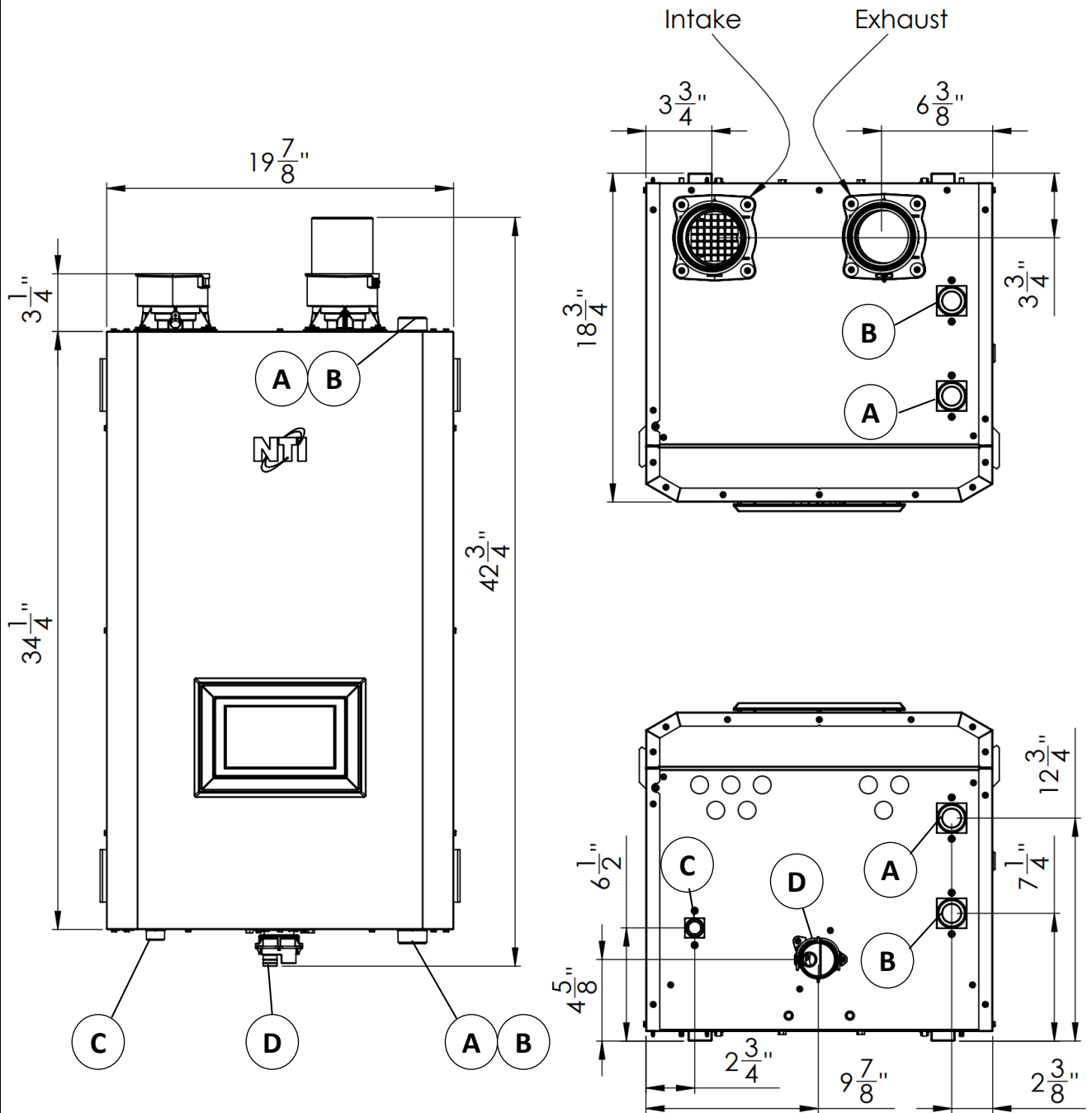


Connection/Description	Size	Connection/Description	Size
A – Central Heating Supply	1-1/4 in.	C – Gas Inlet	3/4 in.
B – Central Heating Return	1-1/4 in.	D – Condensate Drain	*

\* Condensate trap is factory installed inside the boiler, connect drain to drain tube supplied with the boiler.



Figure 2-2 Boiler Dimension (TFTN150-199)

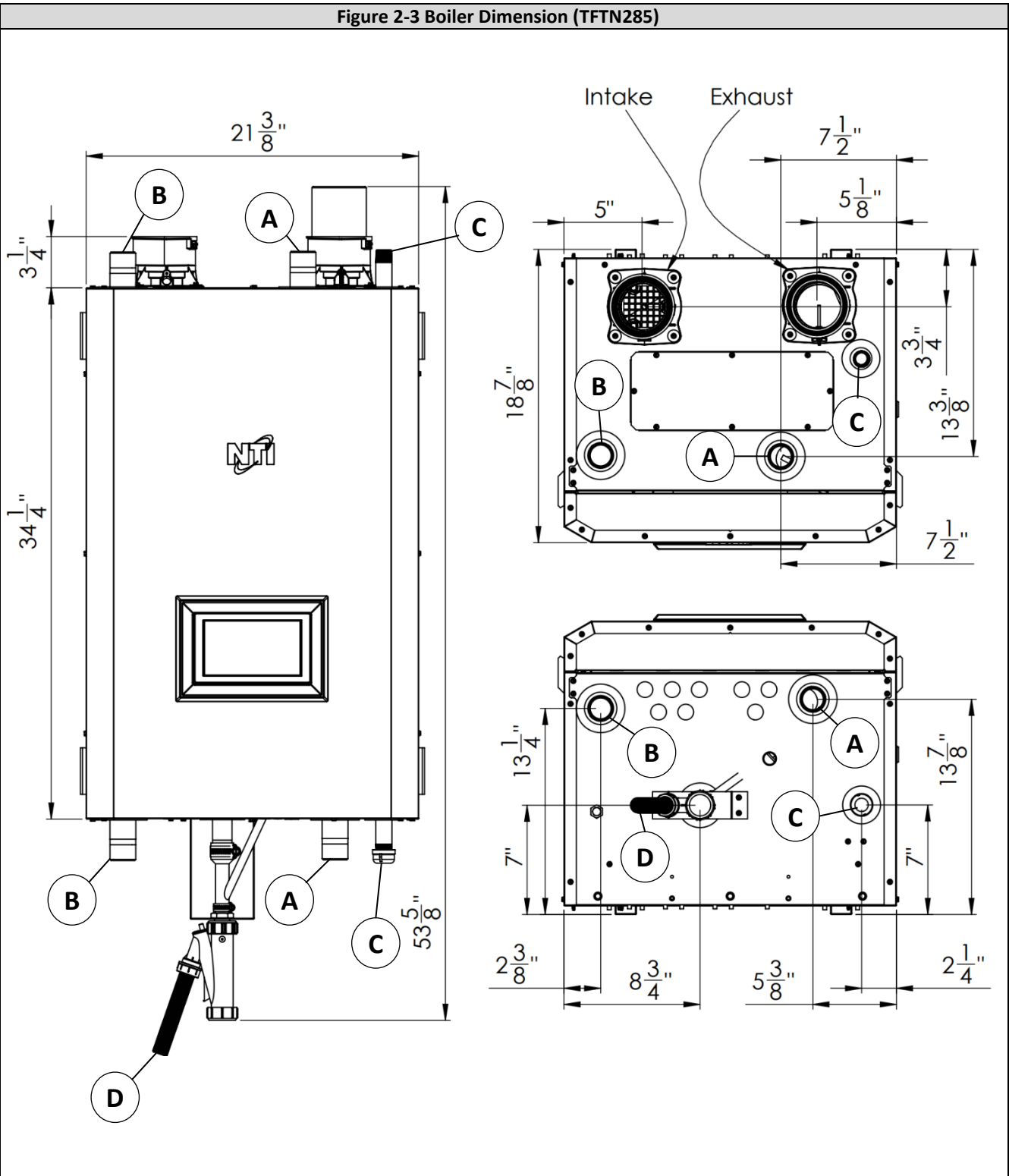


Connection/Description	Size
A – Central Heating Supply	1-1/4 in.
B – Central Heating Return	1-1/4 in.

Connection/Description	Size
C – Gas Inlet	3/4 in.
D – Condensate Drain	*

\* Condensate trap is factory installed inside the boiler, connect drain to drain tube supplied with the boiler.

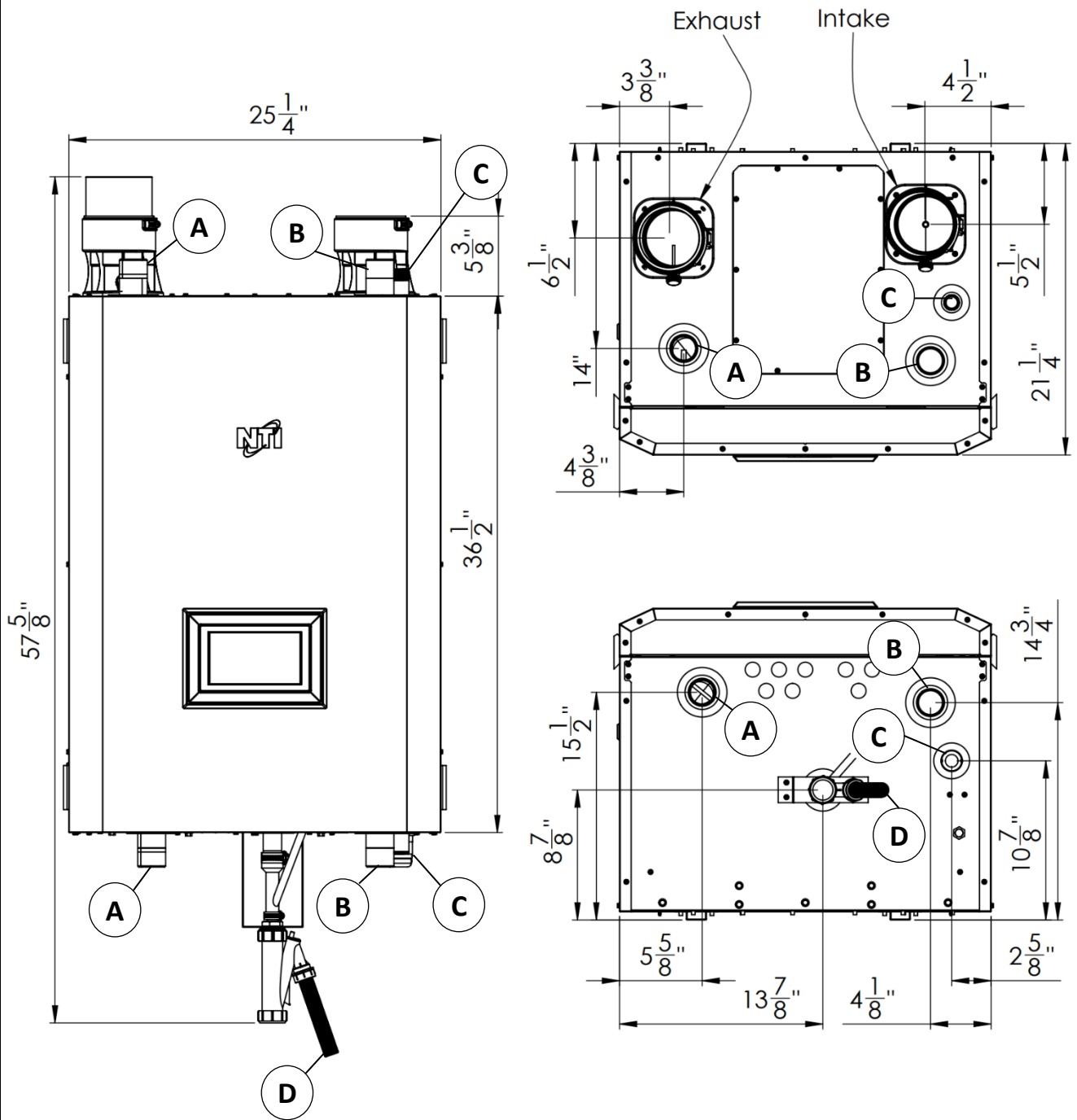
Figure 2-3 Boiler Dimension (TFTN285)



Connection/Description	Size	Connection/Description	Size
A – Central Heating Supply	1-1/4 in.	C – Gas Inlet	3/4 in.
B – Central Heating Return	1-1/4 in.	D – Condensate Drain	*

\* The condensate trap is shipped separately with the boiler, and must be field installed; see [section 6.0](#).

Figure 2-4 Boiler Dimension (TFTN340-399)



Connection/Description	Size
A – Central Heating Supply	1-1/2 in.
B – Central Heating Return	1-1/2 in.

Connection/Description	Size
C – Gas Inlet	3/4 in.
D – Condensate Drain	*

\* The condensate trap is shipped separately with the boiler, and must be field installed; see [section 6.0](#).

### 3.0 BOILER LOCATION

In all cases, the TFTN boiler must be installed indoors in a dry location where the ambient temperature must be maintained above freezing and below 100°F [38°C]. All boiler components must be protected from dripping, spraying water, or rain during operation and servicing. Consider the proximity of system piping, gas and electrical supply, condensate disposal drain, and proximity to vent termination when determining the best boiler location.

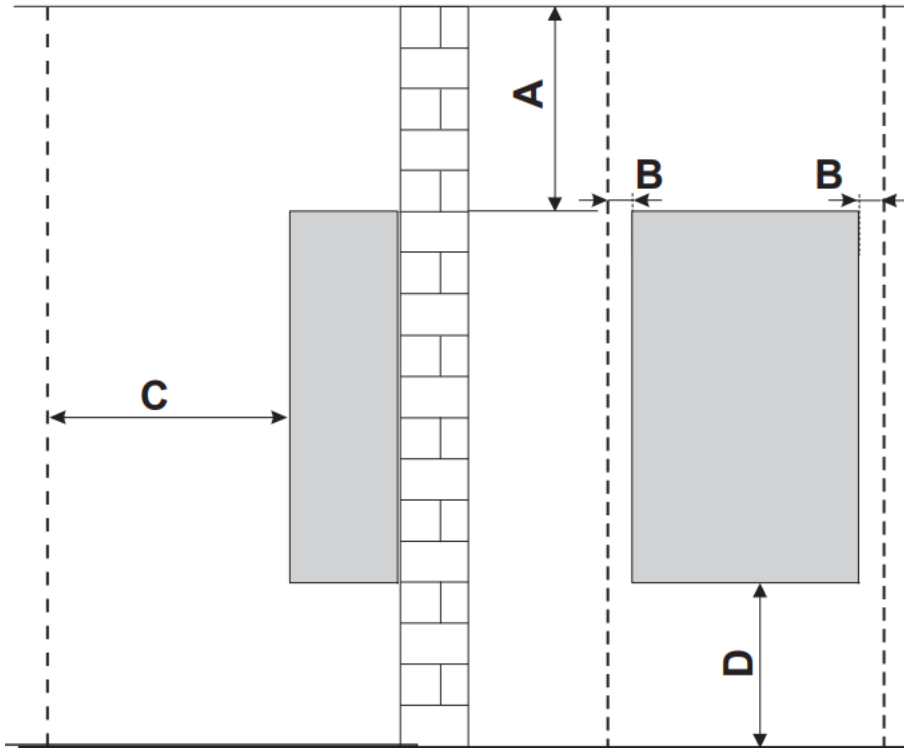


**WARNING**

Water or flood damaged components must be replaced immediately with new factory-approved components as failure to do so may result in fire, serious injury, or death.

### 3.1 Minimum Installation Clearances

Figure 3-1 Minimum Clearance for Installation and Service



Dimension	Description	Clearance	
		Minimum	Recommended
A	Top	12 in.	24 in.
B	Sides	2 in.	12 in.
C <sup>1</sup>	Front	18 in.	36 in.
D	Bottom	14 in.	24 in.
Not Illustrated	Back	0	0
	Flue & Water Pipes	1 in.	1 in.

**Notes:**

<sup>1</sup> Front clearance can be as little as 6" if surface is removable allowing a minimum of 18" clearance.

### 3.2 Boiler Area Ventilation Air Openings

**Direct Vent** – If boiler area clearances are less than the recommended clearances specified in Figure 3-1, the boiler area must be ventilated (**Exception:** if the boiler area/room has a volume of 150 ft<sup>3</sup> or greater, ventilation of the boiler room is not required). Each ventilation air opening must meet the minimum requirements of 1 in<sup>2</sup> per 1000 Btu/hr, but not less than 100 in<sup>2</sup>. The lower ventilation opening must be located within 6” of the floor while the upper opening must be located 6” from the top of the space.

#### NOTICE

If the "Boiler Area" does not meet the recommended clearances listed in Figure 3-1, and if the boiler area has a volume less than 150 ft<sup>3</sup>, it is considered a Closet or Alcove. PVC vent pipe and fittings shall not be used within the closet or alcove; only approved CPVC, Polypropylene or Stainless-Steel vent pipe and fittings can be used. See Table 4-3 for a list of approved materials. Under all circumstances, the minimum clearances listed in Figure 3-1 must be provided.

**Power Vent / Indoor Combustion Air** – When using Indoor Combustion Air in lieu of Direct Vent air intake piping, provisions for combustion and ventilation air, in accordance with section “Air for Combustion and Ventilation,” of the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* (U.S.), or Clause 8.2, 8.3 or 8.4 of *Natural Gas and Propane Installation Code, CAN/CSA B149.1* (Canada), or applicable provisions of the local building codes, must be adhered to.

**Closet Installations** – For closet installations it is necessary to provide two ventilation air openings, each with a minimum area equal to 1 in<sup>2</sup> per 1000 Btu/hr, but not less than 100 in<sup>2</sup>, and within 6” of the top and bottom of the closet door. See Figure 3-1 for minimum clearances.

**Alcove Installations** – Alcove installations have the same minimum clearances as closet installations, except the front must be completely open to the room at a distance no greater than 18” [457 mm] from the front of the boiler and the room is at least three (3) times the size of the alcove. Provided these conditions are met, the boiler requires no extra ventilation air openings to the space. See Figure 3-1 for minimum clearances.

#### WARNING

Closet/alcove installations in US and Canada require approved CPVC, Polypropylene or Stainless-Steel vent and air intake pipe and fittings (see Table 4-3); PVC is not permitted. Failure to follow these instructions may result in damage or serious injury.

### 3.3 Residential Garage Installations

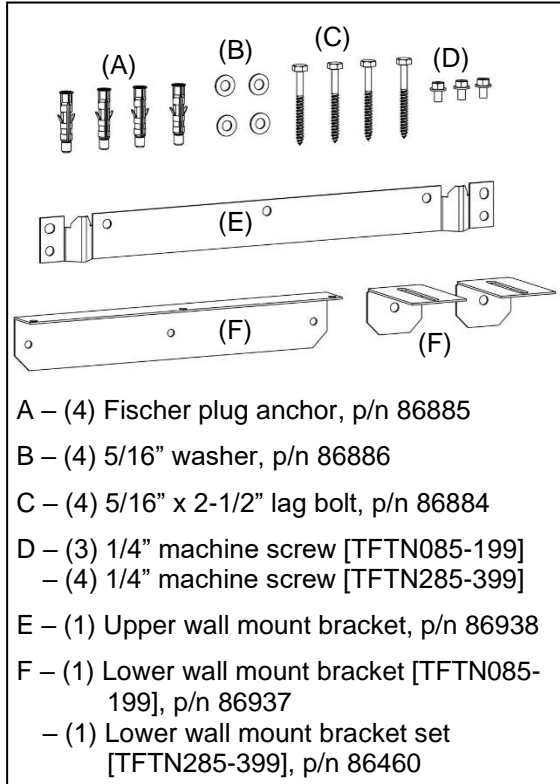
When installed in a residential garage, mount the boiler a minimum of 18” [457 mm] above the floor. Locate or protect the boiler so it cannot be damaged by a moving vehicle. Check with your local authorities for other possible regulations pertaining to the installation of a boiler in a garage.

### 3.4 Wall Mounting Instructions

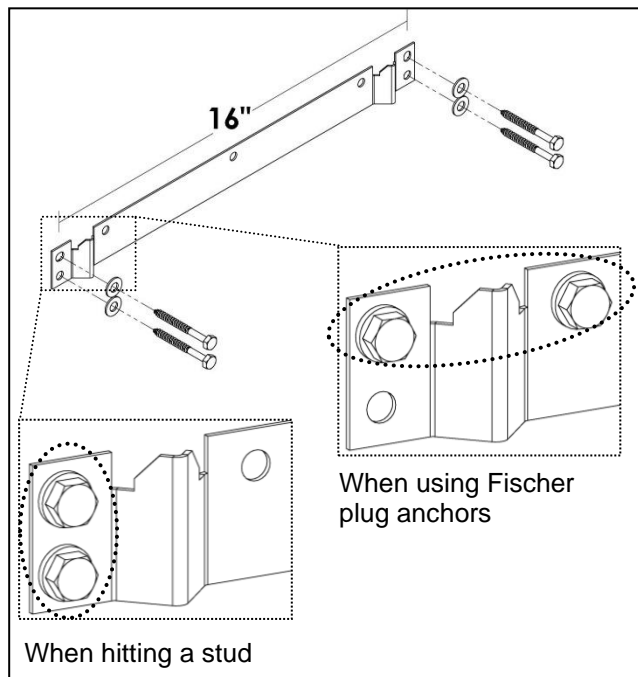
The TFTN is provided with integrated wall mounting brackets. Refer to Figure 3-2 for instructions and illustrations on wall mounting.

Figure 3-2 Wall Mounting Instructions

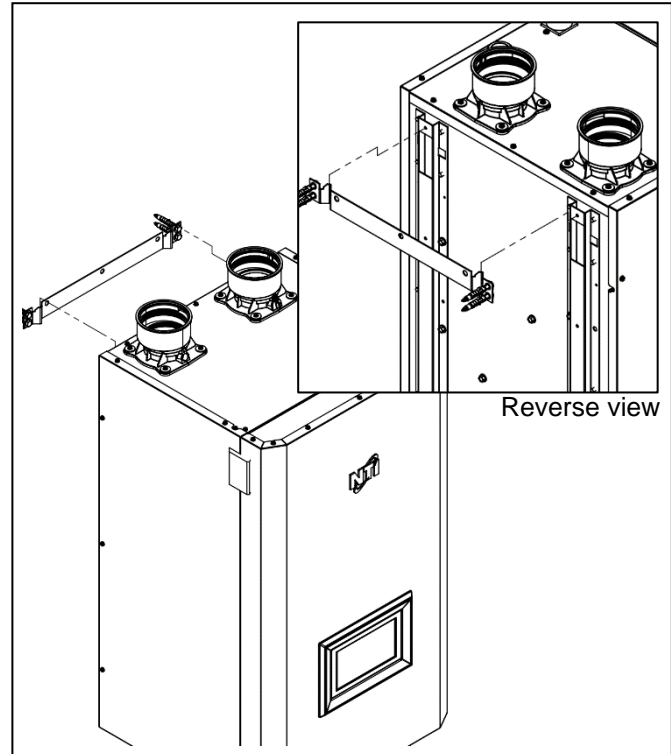
- 1** Locate the wall mounting brackets and hardware furnished with the boiler.



- 2** Secure the upper wall mount bracket to the wall using the supplied lag bolts and washers. Ensure the bracket is level. Use the Fischer plug anchors if a stud is not available.

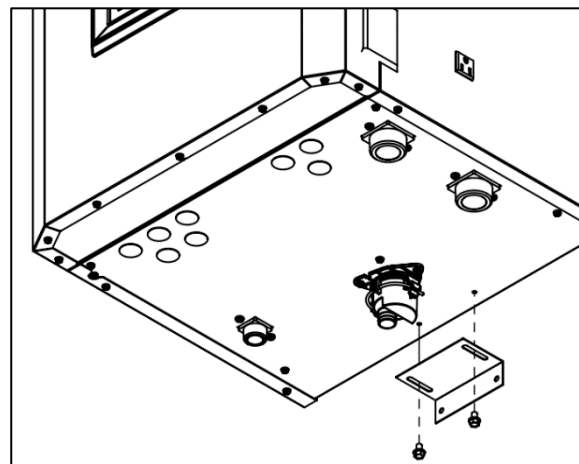


- 3** With the help of an assistant, hang the boiler on the upper wall mount bracket. Align the openings in the back of the boiler with the hooks of the wall mount bracket. Make sure that it is securely hooked and that the wall mount bracket remains securely fastened to the wall.



**CAUTION** Two people are required to lift the boiler into place. Failure to follow these instructions may result in property damage or personal injury

- 4** Loosely install the lower wall mount bracket(s) to the bottom of the boiler, and then fasten the bracket to the wall with field supplied hardware. Tighten the bracket to the bottom of the boiler once the boiler is plumb.



## 4.0 GENERAL VENTING

The TFTN is certified as a “Category IV” boiler requiring a “Special Venting System” designed for pressurized venting. The Exhaust must be piped to the outdoors, using the vent materials and rules outlined in this section. Under no conditions may this unit vent gases into a masonry chimney, unless it is vacant, and utilizes the approved venting material and rules described in this section.



The venting system shall be installed in accordance with the instructions contained within this document and, if applicable, the venting system manufacturer’s instructions. Failure to properly install the venting system may result in flue gas spillage or recycling, causing property damage, personal injury, or death.



Exhaust and Air Intake are to be piped separately. The TFTN cannot share a common vent or air intake with multiple boilers unless the common venting system has been certified by NTI (Contact NTI for details). Failure to comply will result in serious injury or death.

### 4.1 Removing an Existing Boiler from Common Venting System



Do not install the TFTN into a common venting system with any other boiler. Failure to comply with this warning will cause flue gas spillage and leech carbon monoxide emissions into the surrounding air resulting in serious injury or death.



When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the remaining boilers connected to it. Instructions have been provided on how to remove the existing boiler and how to resize the remaining venting system. Failure to follow these instructions may result in property damage, serious injury or death.

Upon removal of an existing boiler, the following steps shall be followed for each boiler remaining in the common venting system; prior to commencing this procedure, shutdown all boilers remaining in the common venting system.

#### Steps to Removing an Existing Boiler:

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch. Verify that there is no blockage, restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close fireplace dampers, all building doors and windows and all doors between the space in which the boilers remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any boiler 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. Do not operate a summer exhaust fan.
4. Place in operation the boiler being inspected. Follow the applicable lighting instructions. Adjust thermostat so boiler will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
6. After it has been determined that each boiler remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning boiler to their previous condition of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms to the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

### 4.2 Combustion Air Intake Contamination

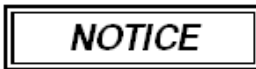
Be careful not to locate the air intake termination in an area where contaminants can be drawn in and used for combustion. Combustion air containing dust, debris or air-borne contaminants will drastically increase the required maintenance and may cause a corrosive reaction in the Heat Exchanger which could result in premature failure, fire, serious injury, or death. See Table 4-1 for a list of areas to avoid when terminating air intake piping:

**Table 4-1 Corrosive Products and Contaminant Sources**

Products to Avoid	Contaminated Sources to Avoid
Antistatic fabric softeners, bleaches, detergents, cleaners	Laundry facilities
Perchloroethylene (PCE), hydrocarbon-based cleaners	Dry cleaning facilities
Chemical fertilizer, herbicides/pesticides, dust, methane gas	Farms or areas with livestock and manure
Paint or varnish removers, cements or glues, sawdust	Wood working or furniture refinishing shops
Water chlorination chemicals (chloride, fluoride)	Swimming pools, hot tubs
Solvents, cutting oils, fiberglass, cleaning solvents	Auto body or metal working shops
Refrigerant charge with CFC or HCFC	Refrigerant repair shops
Permanent wave solutions	Beauty shops
Fixer, hydrochloric acid (muriatic acid), bromide, iodine	Photo labs, chemical / plastics processing plants
Cement powder, crack fill dust, cellulose, fiber-based insulation	Concrete plant or construction site



Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other boiler. Failure to follow instructions may result in serious injury or death.



It is **BEST PRACTICE** to pipe the combustion air intake directly to the outdoors (Direct Vent installation) to avoid contamination often contained in indoor air.

### 4.3 Flammable Solvents and Plastic Piping

Due to the extremely flammable characteristics of most glues, cements, solvents, and primers used in the process of joining plastic vent and air intake pipe, explosive solvent vapors must be evacuated from the vent and air intake prior to start-up. Avoid using excess cement or primer that may lead to pooling inside the pipe assembly. Freshly assembled piping assembly should be allowed to cure for a minimum of 8 hours before applying power to the gas fired boiler. Refer to **Mandatory Pre-commissioning Procedure for Plastic Venting** in this section.



**Flammable Cements and Primers** – It is the installers’ responsibility to familiarize themselves with the hazards associated with explosive solvents and to take all precautions to reduce these risks. Failure to follow these instructions can cause explosions, property damage, injury, or death.

### Mandatory Pre-commissioning Procedure for Plastic Venting (PVC or CPVC)



Do not apply power to the boiler prior to Step 4 in the Mandatory Pre-commissioning Procedure for Plastic Venting.

- 1) Working with the power turned off to the boiler, completely install the vent and air intake system, securely cementing joints together. If possible, allow primers/cements to cure for 8 hours before firing the burner. If curing time is less than 8 hours, proceed with Steps 2 through 6.
- 2) Maintain the boiler gas supply shut-off valve in the off position.
- 3) Remove the cable from the Spark Ignition Transformer.



**Spark Ignition Circuit - Maintain a safe distance (2 inches minimum) from the spark ignition circuit to avoid injury from electrical shock.**

- 4) Turn power on to the boiler and apply a heat demand.
- 5) Allow for 3 complete trials for ignition, consisting of pre and post purge of the combustion blower, until an ignition lockout occurs. Repeat the process two more times (i.e., 9 complete ignition sequences in total).
- 6) Turn power off and reconnect the cable to the Spark Ignition Transformer.



### 4.4 Boiler Exhaust & Air-Intake Vent Pipe Connectors

The TFTN employs universal exhaust and air-intake connectors that accept PVC/CPVC or Polypropylene (or in the case of the TFTN340-399, Stainless-Steel) special gas vent; see Figure 4-1.

**Note:** When inserting the vent pipe into the connector, verify that the gasket is lubricated and properly seated, and that pipe ends are cut square and beveled at approximately 1/8 in. to avoid damaging or dislodging the gasket during installation.



**Gasket Sealing** – Failure to properly prepare the vent pipe and gasket before installation may cause gasket seal failure resulting in property damage, serious injury or death.

**PVC Exhaust Piping** – When venting the exhaust with PVC, use the supplied CPVC Transition Pipe provided with the boiler; insert the CPVC pipe into the exhaust connector and cement the other end to the PVC exhaust venting using a field supplied PVC or CPVC coupling. See Figure 4-1.



**DO NOT** insert PVC pipe directly into the boiler exhaust connector, as it can deform from the clamping force of the gear clamp. Failure to follow these instructions may result in gasket failure and/or the dislodging of the exhaust vent from the connector, resulting in property damage, serious injury or death.

**Polypropylene Piping** – TFTN085-285 exhaust and air-intake connectors accept approved 3 in. Polypropylene special gas vent with 80 mm outside diameter. TFTN340-399 exhaust and air-intake connectors accept approved 4 in. Polypropylene special gas vent with 100 mm outside diameter.

**Note:** 4 in. Polypropylene with 110 mm outside diameter must be adapted to fit the boiler vent pipe connector using the applicable field supplied adapter; see Table 4.2

**Stainless-Steel Piping** – TFTN340-399 exhaust and air-intake connectors accept approved 4 in. Stainless-Steel special gas vent with a 4 in. outside diameter. TFTN085-285 exhaust and air-intake connectors do not accept Stainless-Steel vent; to vent these models with Stainless-Steel, use the applicable field supplied adapter – See Table 4.2.



Failure to use the appropriate exhaust vent adaptor for the type of venting being used will lead to flue gas leakage possibly resulting in property damage, Carbon Monoxide poisoning or death.



Follow the Special Gas Venting manufacturer’s assembly instructions. **DO NOT** connect Polypropylene vent pipes & fittings, or Stainless-Steel vent pipes & fittings, together unless they are of the same brand and type. Failure to follow these instructions may lead to flue gas leakage possibly resulting in property damage, Carbon Monoxide poisoning or death.

**Table 4-2 Appliance Adapters for Polypropylene and Stainless-Steel Venting**

Vent Material	Venting Brand	Adapter Part No.	
		TFTN085-285	TFTN340-399
Polypropylene	DuraVent (PolyPro®)	NA <sup>1</sup>	NA <sup>2</sup>
	Centrotherm (InnoFlue®)		ISAAL0404
	Z-Flex (Z-Dens®)		2ZDCPVC4
Stainless Steel	DuraVent (FasNSeal®)	810005378	NA <sup>2</sup>
	Z-Flex (Z-Vent®)	2SVSTTA03	

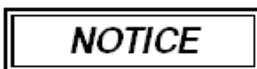
**Notes:**

<sup>1</sup> TFTN085-285 exhaust and air-intake connectors are designed to directly accept 3 in. Polypropylene Special Gas Vent.

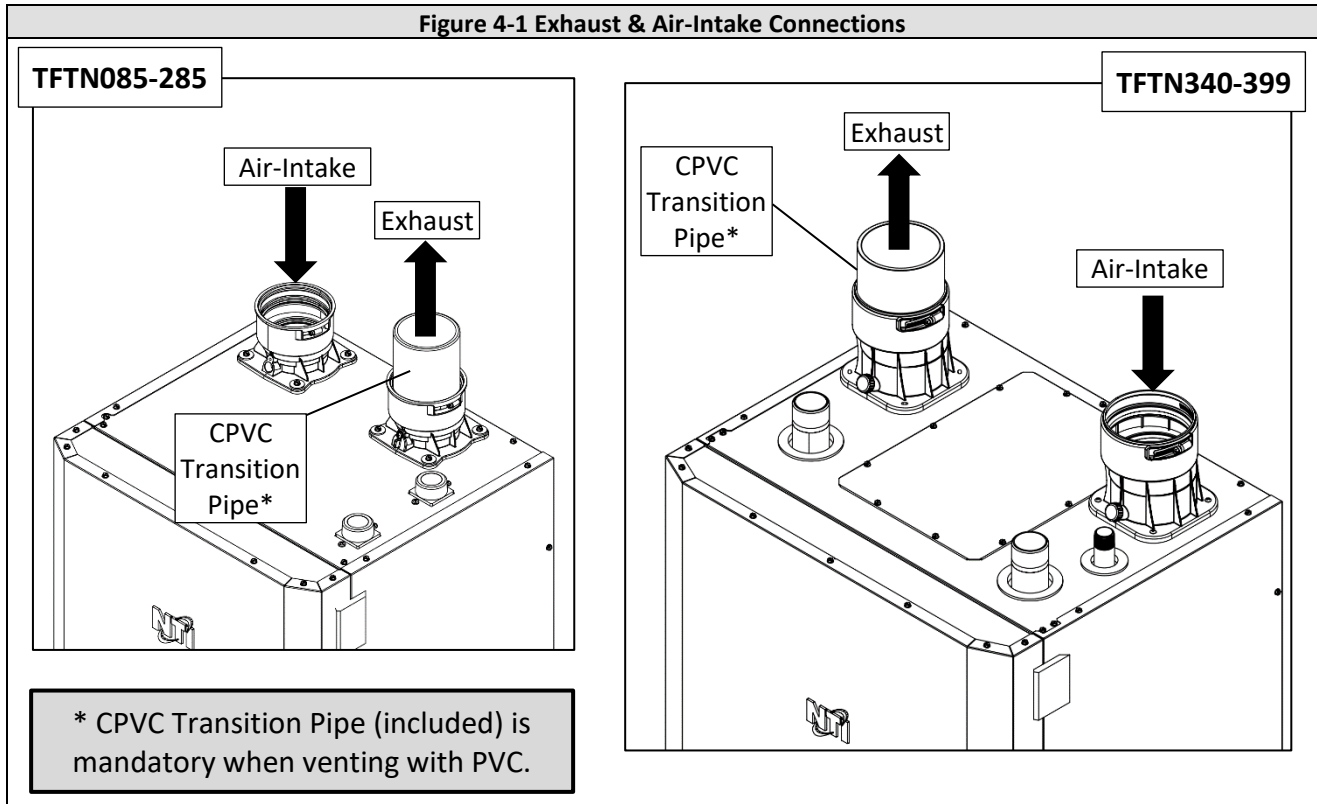
<sup>2</sup> TFTN340-399 exhaust and air-intake connectors are designed to directly accept 4 in. DuraVent PolyPro® Polypropylene Special Gas Vent, as well as 4 in. DuraVent FasNSeal and Z-Flex Z-Vent® Stainless Steel Special Gas Vent.



Exhaust vent piping must be supported to reduce strain on piping joints. Failure to follow these instructions may result in damage, serious injury or death.



In Canada, the first **3 ft (915 mm)** of exhaust vent piping must be readily accessible for inspection.



### 4.5 Vent Pipe Material

Table 4-3 Acceptable Exhaust and Air-Intake Vent Pipe Material

Items <sup>1</sup>	Materials <sup>2,3</sup>	Venting System Standards		<div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>WARNING</b> </div>
		United States	Canada	
Vent Pipe and Fittings	PVC – DWV Schedule 40/80	UL-1738 or ANSI/ASTM D2665	ULC S636	Exhaust and Air-Intake materials installed on gas fired appliances in CAN/US must meet the specifications provided in this Table. Failure to comply could result in fire, serious injury or death.
	PVC Schedule 40/80	UL-1738 or ANSI/ASTM D1785		
	CPVC Schedule 40/80	UL-1738 or ANSI/ASTM F441		
	Stainless-Steel (SS)	UL-1738		
	Polypropylene (PP)	UL-1738 or ULC S636		
Pipe Cement	PVC	ANSI/ASTM D2564		
	CPVC	ANSI/ASTM F493		
Primers	PVC / CPVC	ANSI/ASTM F656		

**Notes:**

<sup>1</sup> Refer to Tables 4-4 and 4-5 for Allowable Vent Size & Length.

<sup>2</sup> PVC venting (exhaust and air intake) is not permitted within the Closet/alcove of a Closet/alcove installation.

<sup>3</sup> The Air Intake does not require high temperature pipe material; ABS and PVC Foam Core piping is acceptable. Check applicable local codes for acceptable materials.



The use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in the exhaust venting system is prohibited. Failure to follow these instructions may result in property damage, personal injury, or death.



Covering non-metallic exhaust vent pipe and fittings with thermal insulation is prohibited. Failure to follow these instructions may result in property damage, personal injury, or death.

**NOTICE**

The use of double-wall vent or insulated material for the combustion air intake pipe is recommended in cold climates to prevent the condensation of airborne moisture on the incoming combustion air pipe.

**4.6 Exhaust and Air-Intake Vent Size & Length**

TFTN085-285 models are equipped with 3 in. diameter exhaust and air intake collars and can be vented in 3 in. diameter pipe up to a maximum of 150 ft. equivalent for each the exhaust and the air-intake vent. Alternatively, TFTN085-199 models (ONLY) can be vented with 2 in. diameter pipe up to a maximum of 100 ft. equivalent for each the exhaust and air-intake vent.

**NOTE:** a reducing coupling **MUST BE USED** when transitioning from 3 in. to 2 in. vent pipe. **DO NOT** use reducing bushings.

TFTN340-399 models are equipped with 4 in. diameter exhaust and air intake collars and can be vented in 4 in. diameter pipe up to a maximum of 150 ft. equivalent for each the exhaust and the air-intake vent.

Use Tables 4-4 and 4-5 to determine the maximum pipe length and number of fittings that can be used to make up the exhaust and air-intake venting.

**Table 4-4 Allowable Vent Size & Length**

Pipe Size (in.)	Model	Exhaust Vent Length (ft.) *	Air-Intake Vent Length (ft.) *
2	TFTN085-199	6 - 100	0 - 100
	TFTN285	0 - 6	NA
3	TFTN085-285	6 - 150	0 - 150
	TFTN340-399	0 - 6	NA
4	TFTN340-399	6 - 150	0 - 150

**Table 4-5 Equivalent Length of Fittings**

Fitting	Equivalent Length (ft.)
90 Degree Elbow	5
45 Degree Elbow	3
Coupling	0
Concentric Vent	3
Each foot of vent pipe	1

\* Lengths represent the allowable equivalent pipe length; see Table 4-5 for a list of equivalent lengths of fittings.

**4.7 Direct Vent Installation**

When installed as a Direct Vent boiler the combustion air intake must also be piped directly to the outdoors using the methods described in this section and in accordance with the National Fuel Gas Code, ANSI Z223.1 (U.S.) or CSA B149.1 (Canada) and local requirements.

**Termination Options**

The venting system of the TFTN may be terminated using field supplied piping to construct a “Two-Pipe” termination; see Figures 4-2(a)(e)(h), 4-3(a), 4-4(a)(d), 4-5, 4-6 and 4-7. Alternatively, the venting may be terminated using a factory kit selected from Table 4-7; see Figures 4-2(b)(c)(d)(f)(g), 4-3(b)(c)(d) and 4-4(b)(c).

**IMPORTANT**

**Sidewall Termination** - Due to potential moisture loading (build-up) along the exterior wall, sidewall venting may not be the preferred venting option. Refer to Figures 4-2(e)(f)(g)(h) and 4-4(a)(b)(c)(d) for roof top venting options.

**NOTICE**

When sidewall venting, it is recommended to reduce the diameter of the exhaust vent at the termination, to increase exhaust gas velocity, further directing it away from the building. The final 6 ft. of exhaust vent can be reduced to a diameter of 2 in. for models TFTN085-285, and 3 in. for models TFTN340-399.

**WARNING**

The vent for this appliance shall not terminate over public walkways; or near soffit vents or crawl space vents or other area where condensate of 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.

**WARNING**

Extra precaution must be taken to adequately support the weight of the Exhaust/Air Intake piping in applications using roof-top terminations. Failure to follow these instructions may result in venting or boiler component failure resulting in flue gas spillage leading to property damage, serious injury or death.

### Optional Termination Kits

Kits certified with the TFTN are listed in Table 4-7 and available from the manufacturers listed in Table 4-6. Kits with an NTI part number listed in Table 4-7, are available directly from NTI.

**Table 4-6 Optional Termination Kit OEMs**

Venting Brand	Vent Manufacturer	Contact Information
System 636®	IPEX Inc.	www.ipexinc.com
PolyPro®	DuraVent	www.duravent.com
InnoFlue®	Centrotherm Eco Systems	www.centrotherm.us.com
Z-DENS®	Z-Flex Venting Systems	www.z-flex.com

**Table 4-7 Optional Vent Termination Kits**

Description	Vent Size	Supplier P/N	Figure	Vent Material Compatibility	Vent Option	
					Roof	Wall
IPEX Low Profile (Wall) <sup>7</sup>	2"	196984 (NTI P/N 85062)	4-2(b), 4-3(c)	PVC/CPVC <sup>7</sup>	-	✓
	3"	196985 (NTI P/N 84357)				
	4"	196986 (NTI P/N 84358)				
IPEX Concentric (Wall/Roof) <sup>5,6,7,8</sup>	2"	196125	4-2(c)(f), 4-3(b), 4-4(b)	PVC/CPVC <sup>7</sup>	✓	✓
	3"	196116 (NTI P/N 84634), 197117				
	4"	196021 (NTI P/N 84355), 197021				
PolyPro® Twin Pipe (Wall)	4"	4PPS-HTPL		PolyPro® Polypropylene	-	✓
PolyPro® Concentric (Wall)	2-4"	2PPS-HK, 3PPS-HK, 4PPS-HK	4-2(d), 4-3(d)		-	✓
PolyPro® Concentric (Roof)	2-4"	2PPS-VK, 3PPS-VK, 4PPS-VK	4-2(g), 4-4(c)		✓	-
InnoFlue® Flush Mount (Wall)	2-3"	ISLPT0202, ISLPT0303		InnoFlue® Polypropylene	-	✓
InnoFlue® Concentric (Wall) <sup>9</sup>	2-4"	(ICWT242 & ICTC0224), (ICWT352 & ICTC0335), (ICWTS462 & ICTC0446)	4-2(d), 4-3(d)			
InnoFlue® Concentric (Roof) <sup>9</sup>	2-4"	(ICRT2439 & ICTC0224), (ICRT3539 & ICTC0335), (ICRT4679 & ICTC0446)	4-2(g), 4-4(c)			
Z-DENS® Horizontal Kit Low Profile (Wall)	3-4"	2ZDHLKP3, 2ZDHLKP4		Z-DENS® Polypropylene	-	✓
Z-DENS® Concentric (Wall)	2-4"	2ZDHK2, 2ZDHK3, 2ZDHK4	4-2(d), 4-3(d)			
Z-DENS® Concentric (Roof)	2-4"	2ZDVK2, 2ZDVK3, 2ZDVK4	4-2(g), 4-4(c)			
Z-VENT® Termination Hood – Exhaust (Wall)	3-4"	2SVSHTX03, 2SVSHTX04, 2SVSHTX05		Z-VENT® Stainless Steel	-	✓

**Notes:**

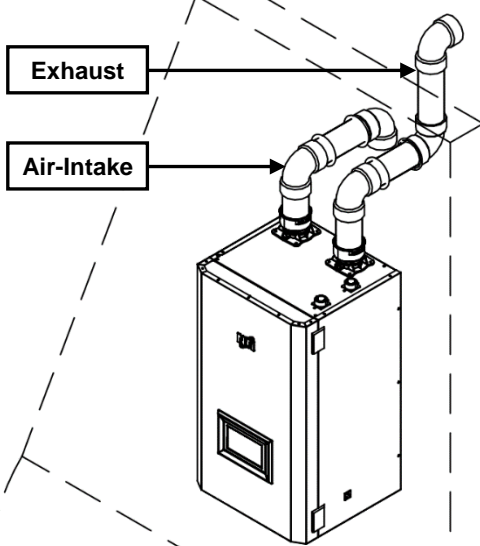
- <sup>1</sup> Instructions included with termination kits contain detailed assembly and installation instructions.
- <sup>2</sup> Concentric kits can be shortened to fit the requirements of the installation; see instructions included with the kit for more details.
- <sup>3</sup> 2 in. Vent Termination Kits may only be used with models TFTN085-285.
- <sup>4</sup> 3 in. Vent Termination Kits may only be used with models TFTN085-399.
- <sup>5</sup> 4 in. Vent Termination Kits may only be used with models TFTN340-399.



**PVC In Canada** – Authorities in some jurisdictions may not allow the use of any PVC venting materials with condensing boilers; check with the local safety inspector to verify compliance prior to installing a PVC Concentric Vent Kit with a TFTN boiler.

### Termination Options – Direct Vent Installation

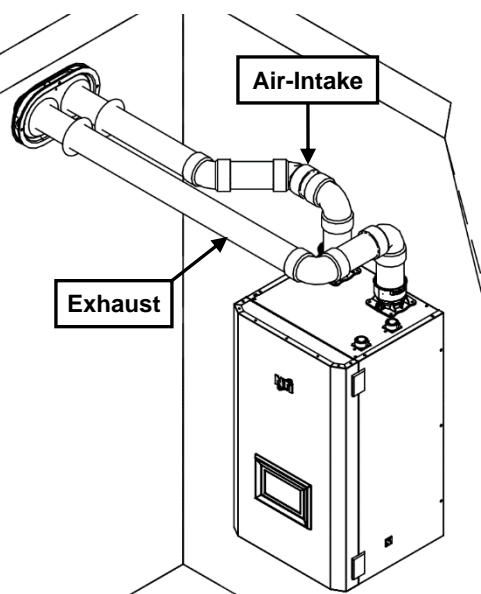
Figure 4-2(a) Two-pipe (Sidewall)



**WARNING**

Location of exhaust and air-intake connections vary between models, see Figure 4-1.

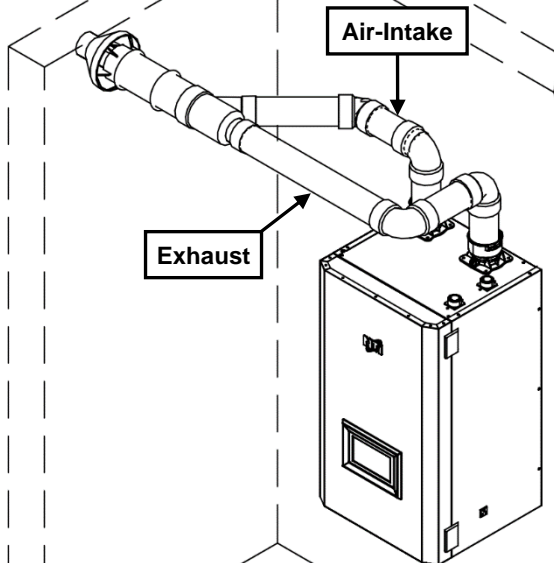
Figure 4-2(b) Low Profile (Sidewall)



**WARNING**

Location of exhaust and air-intake connections vary between models, see Figure 4-1.

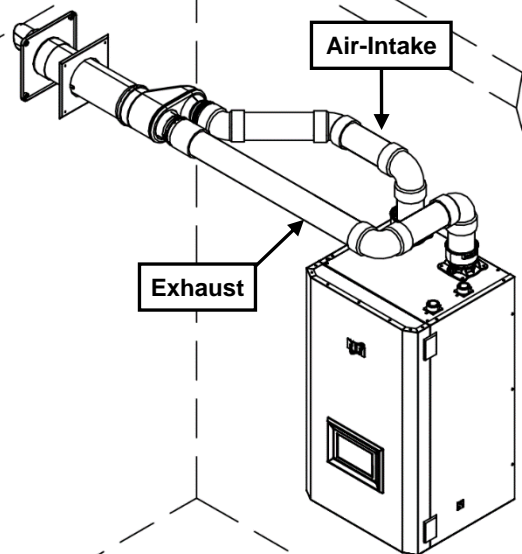
Figure 4-2(c) IPEX Concentric (Sidewall)



**WARNING**

Location of exhaust and air-intake connections vary between models, see Figure 4-1.

Figure 4-2(d) PP Concentric (Sidewall)



**WARNING**

Location of exhaust and air-intake connections vary between models, see Figure 4-1.

Figure 4-2(e) Two-pipe (Roof)

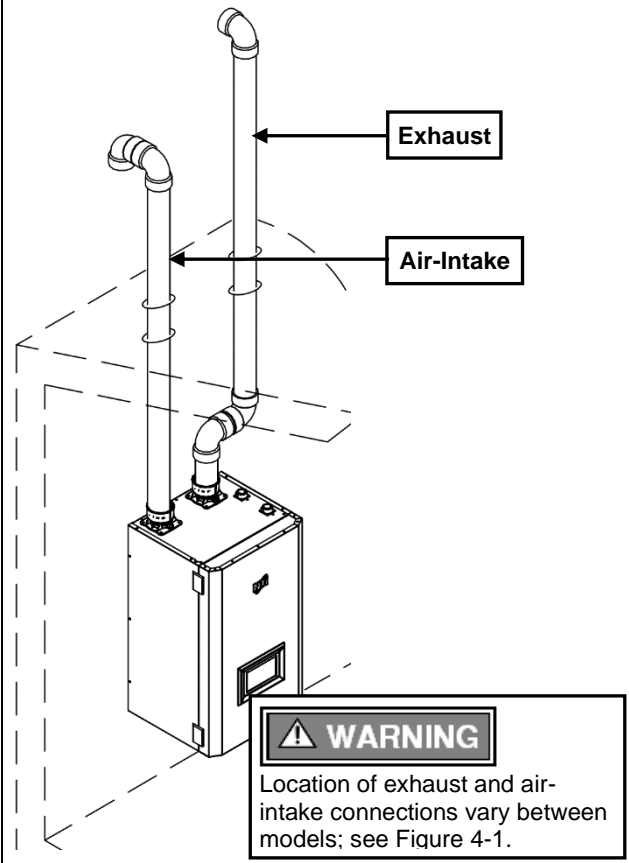


Figure 4-2(f) IPEX Concentric (Roof)

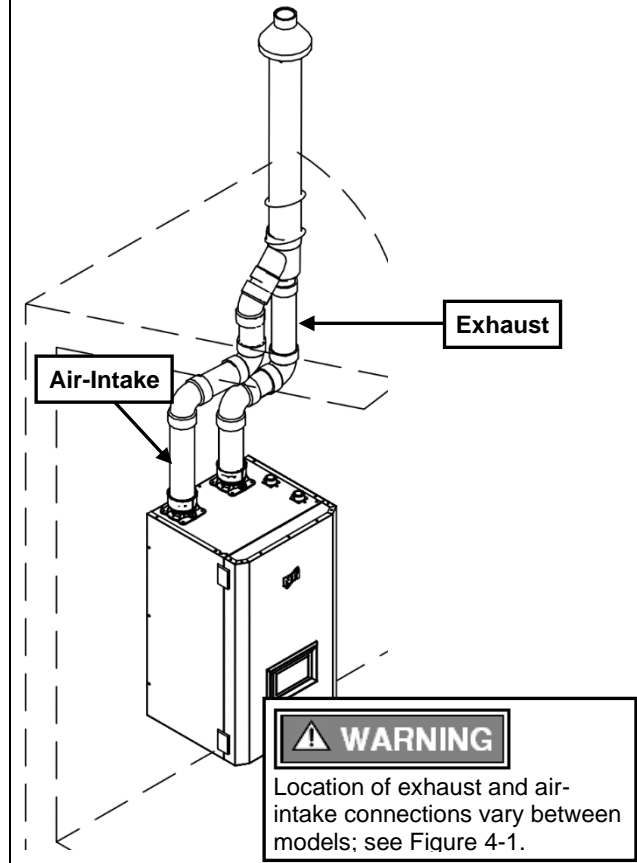


Figure 4-2(g) PP Concentric (Roof)

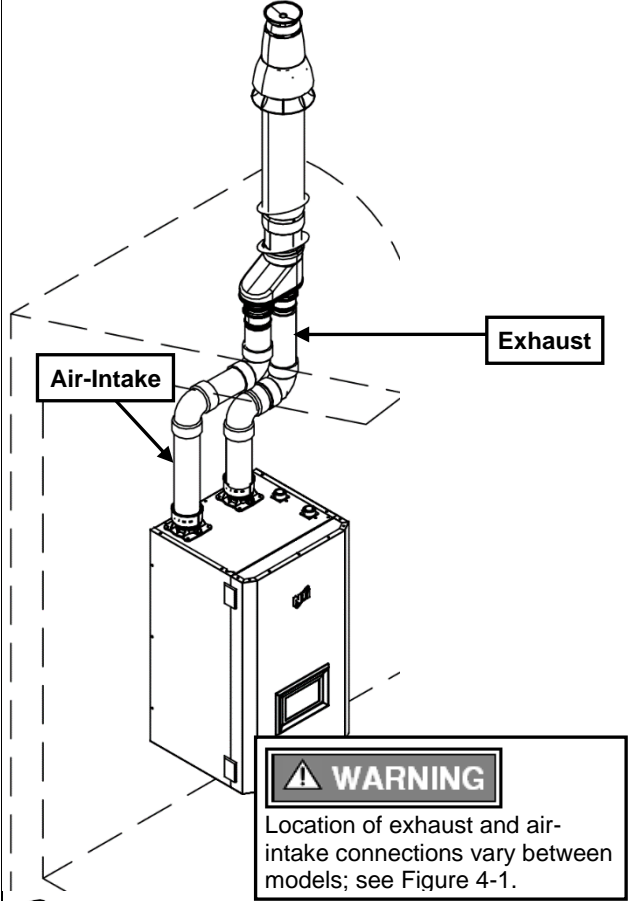
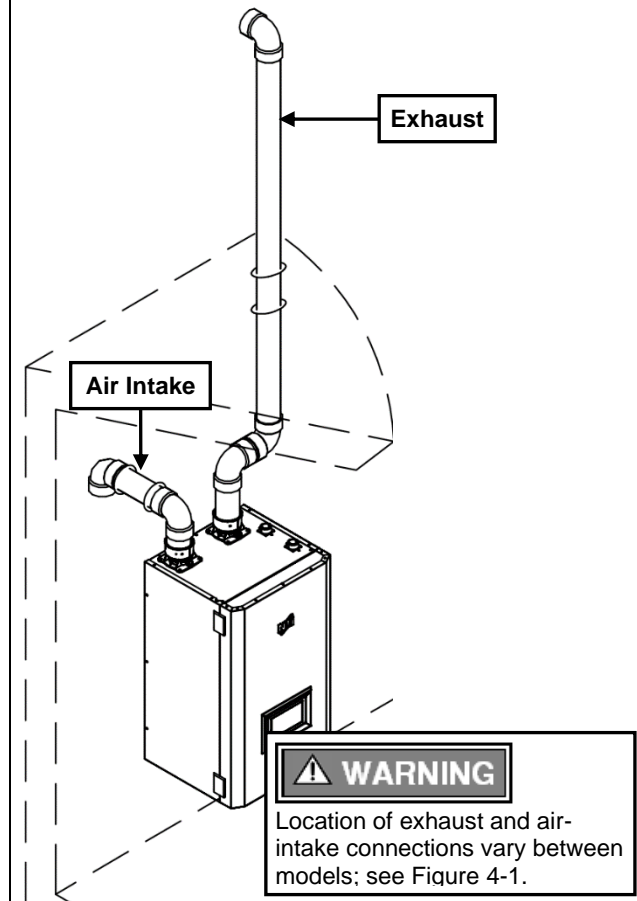
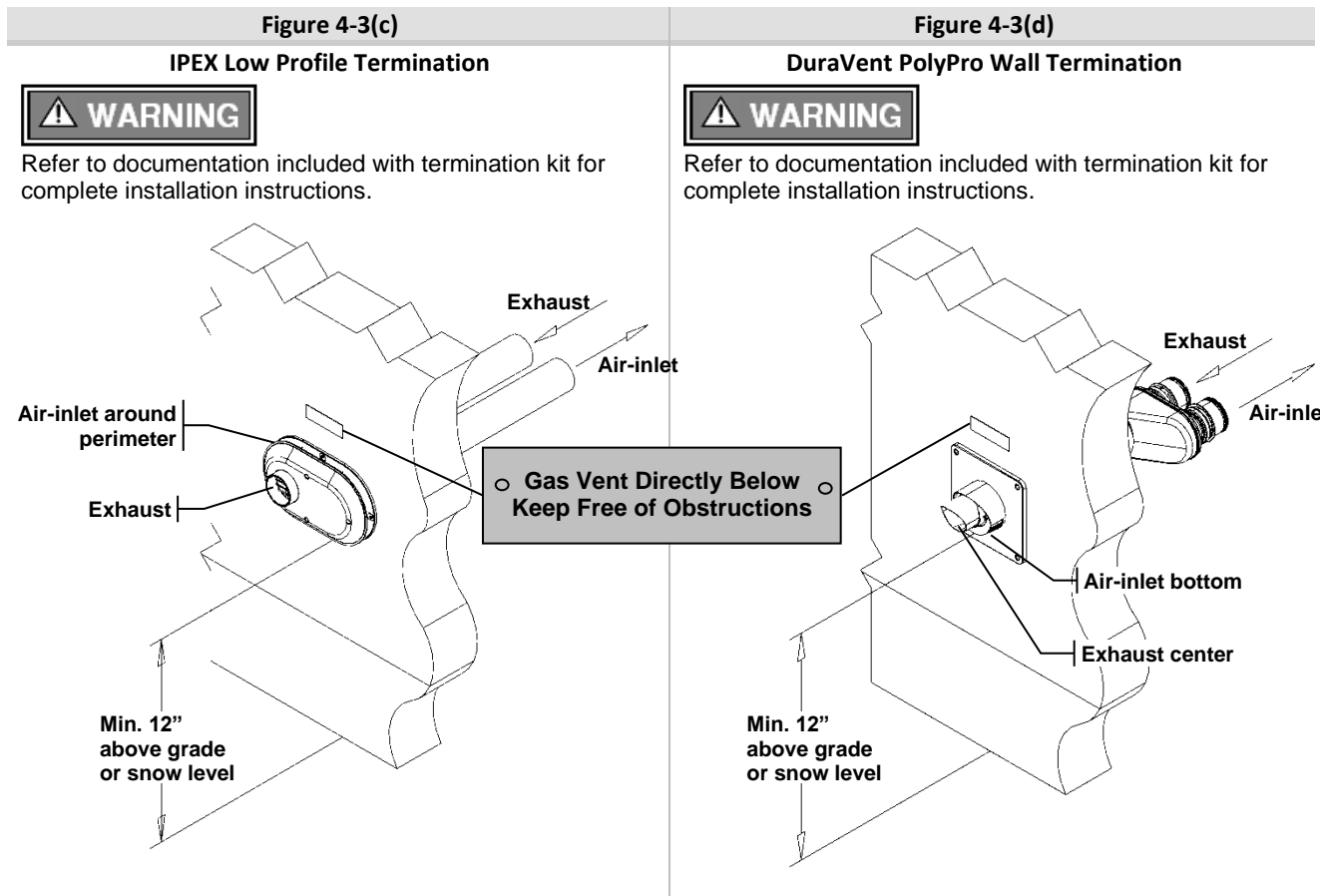
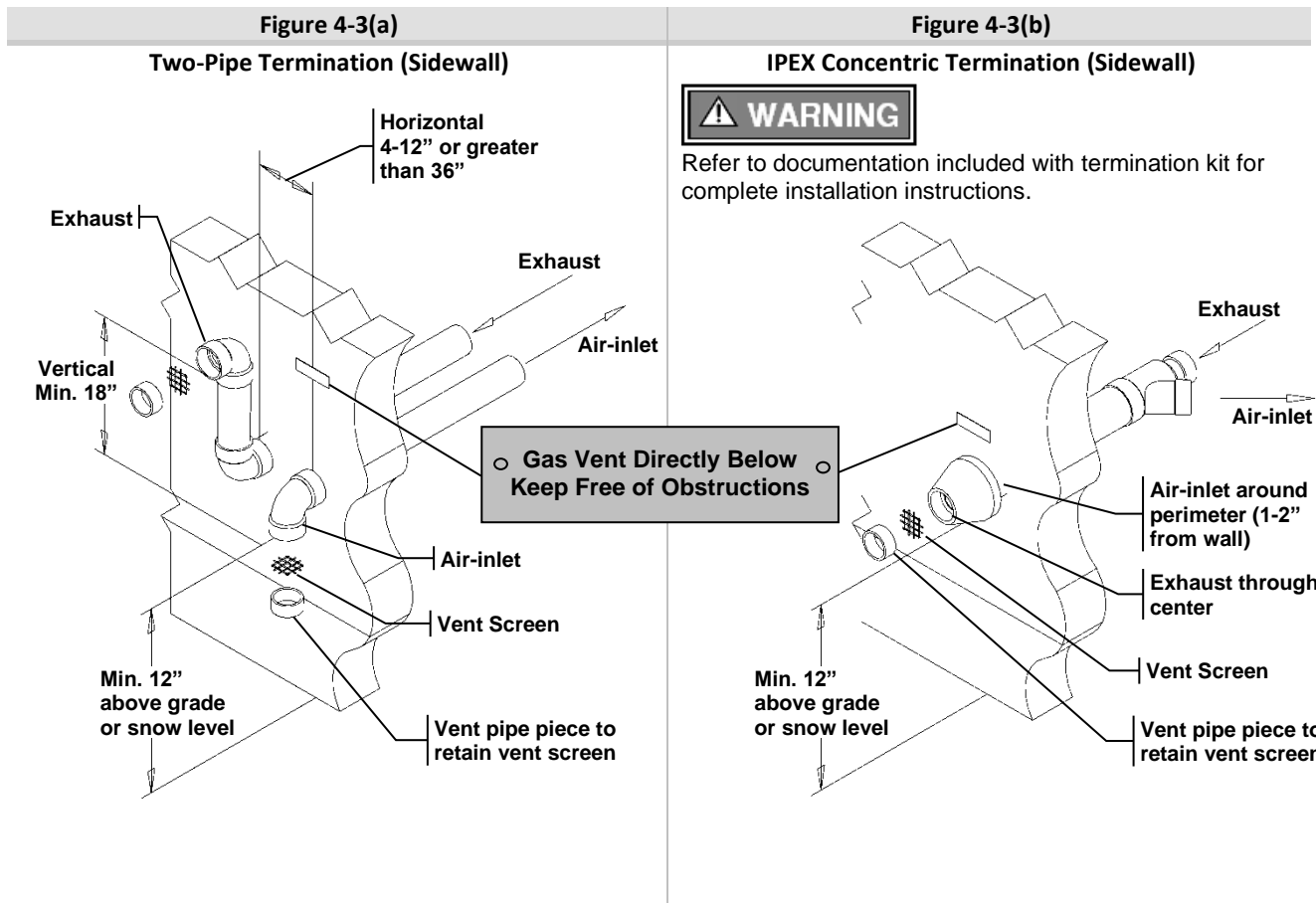


Figure 4-2(h) Two-pipe (Sidewall/Roof)



Sidewall Termination Details



Roof Termination Details

Figure 4-4(a)

Two-Pipe Termination (Roof)

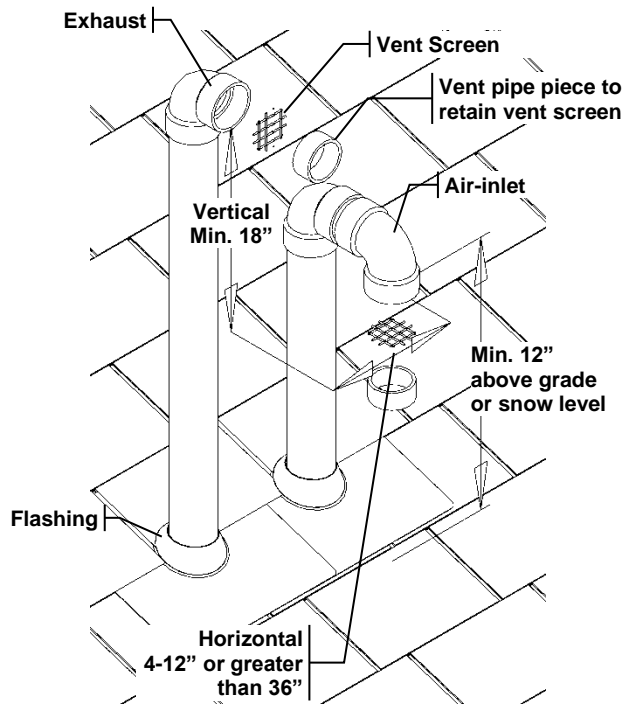


Figure 4-4(b)

IPEX Concentric Termination (Roof)

**WARNING**

Refer to documentation included with termination kit for complete installation instructions.

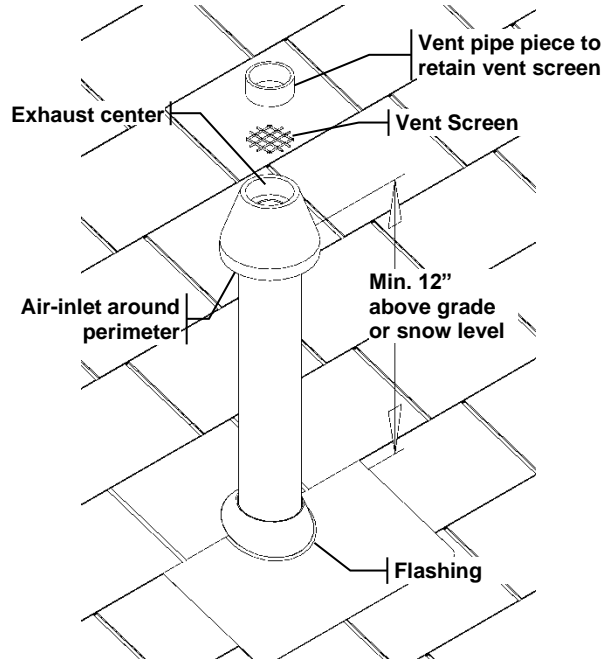


Figure 4-4(c)

DuraVent PolyPro Roof Termination

**WARNING**

Refer to documentation included with termination kit for complete installation instructions.

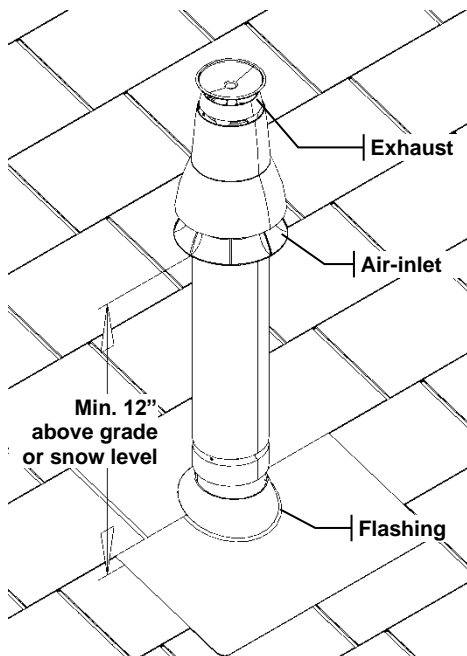
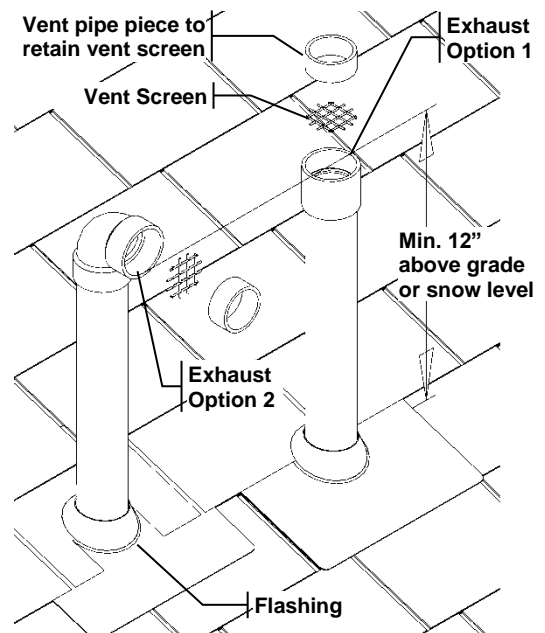


Figure 4-4(d)

Exhaust only Roof Termination

**WARNING**

Figure illustrates two options for exhaust termination only; neither vent pipe illustrated is for combustion air intake.





#### 4.8 Power Vent / Indoor Combustion Air (non-Direct Vent)

When the installation uses Indoor Combustion Air (i.e. piping is not directly connecting the appliance air intake to the outdoors), provisions for combustion and ventilation air, in accordance with section "Air for Combustion and Ventilation," of the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* (U.S.), or Clause 8.2, 8.3 or 8.4 of *Natural Gas and Propane Installation Code, CAN/CSA B149.1* (Canada), or applicable provisions of the local building codes, must be adhered to.

##### NOTICE

The boiler shall be located so as not to interfere with proper circulation of combustion, ventilation, and dilution air.

##### WARNING

Make up air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements. Failure to ensure adequate make up air to all appliances may result in personal injury or death.

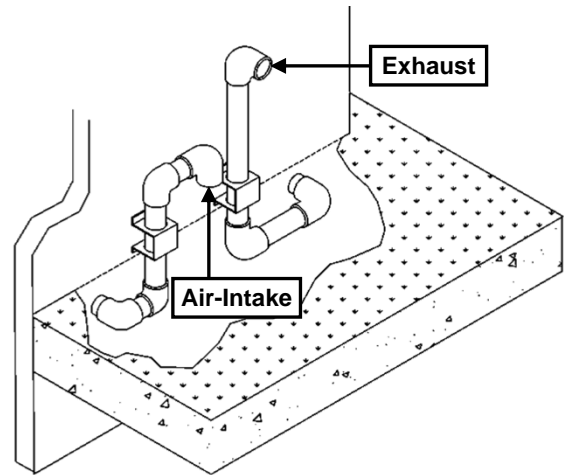
#### 4.9 General Venting Rules and Guidelines

1. **Prevailing Winds:** Ensure the vent is located where it will not be exposed to normal prevailing winds.
2. **Combustion Air Intake Contamination:** Air for combustion must be drawn from an area free of dust and contaminants. Combustion air containing chemicals such as chloride, fluoride, bromine or iodine or dust and debris will cause corrosion damage of the heat exchanger voiding your NTI warranty. Refer to Table 4-1 for a list of corrosive products and contaminants sources to avoid.
3. **Vertical Separation:** The exhaust must be a minimum of 18" above the air inlet, and the air inlet must always be a minimum of 12" plus snow allowance above any surface that will support snow. (2' plus snow allowance is highly recommended). Consult your weather office for the maximum typical snowfall for your region.  
*Example:* New Brunswick Canada - typical maximum snowfall is 19", thus the inlet must be (12"+19") = 31" above grade and exhaust must be (31"+18") = 49" above grade.
4. **Horizontal Separation:** The horizontal distance between the inlet and exhaust must be a minimum of 4" center to center.
5. **Wall Flashing:** Under normal operating conditions this boiler will produce a plume of white gases and should be taken into consideration when selecting an adequate location. A 36" diameter stainless, plastic, or vinyl shield can be used to flash the exterior of the residence.
6. **Flue Gas Hazard:** Position the vent termination where vapors cannot make accidental contact with people and pets or damage nearby shrubs and plants.
7. **Elbow Extensions:** Elbows on outside of wall must be no more than 1/2" away from the wall.
8. **Vent Sloping:** All indoor exhaust piping must be on a slope back to the boiler a minimum of 1/4" per linear foot of vent. For applications where excessive condensation is possible 1/2" per linear foot is recommended.
9. **Vent Supports:** Where required Exhaust and Air Intake piping shall be secured to the wall for more rigidity. All interior vent pipe shall be supported a minimum of every 36".
10. **Roof Exhaust:** In all roof applications the discharge must point away from the pitch of the roof.
11. **Roof Flashing:** Install adequate flashing where the pipe enters the roof, to prevent water leakage.
12. **Rain Cap:** Install and seal a rain cap over existing chimney openings, in vacant chimney applications.
13. **Venting Below Grade:** For installations that exit the wall below grade refer to Figure 4-5.
14. **Vent Screens:** Install factory supplied vent screens on the outside of the last elbow for both the inlet and exhaust vent terminal elbows. Install the screen into the female opening of the elbow, and then cut a small piece of pipe to sandwich the screen into the elbow. NOTE: ensure the small piece of pipe cut, does not extend past the end of the elbow. Two screens are provided in the package. See Figures 4-3 and 4-4.
15. **Condensate Hazard:** Do not locate vent over public walkways, driveways, or parking lots. Condensate could drip and freeze resulting in a slip hazard or damage to vehicles and machinery.
16. **Warning Plate:** For Sidewall Venting, install the warning plate "Gas Vent Directly Below", above (within 4 ft. vertically) the location of the air intake pipe, so it is visible from at least 8 ft. away. See Figure 4-3.
17. **Wall Thickness:** Direct vent terminations are designed to work with any standard wall thickness. Installation guidelines for min/max wall thickness are as follows: Min. = 1", Max. = 60".
18. **Venting Options:** Due to potential moisture loading (build-up) along the exterior wall, sidewall venting may not be the preferred venting option. Refer to Figures 4-2(c), 4-2(d), 4-2(e) and 4-4 for roof top venting options.

**Figure 4-5 Venting Below Grade**

For installations that exit the wall below grade:

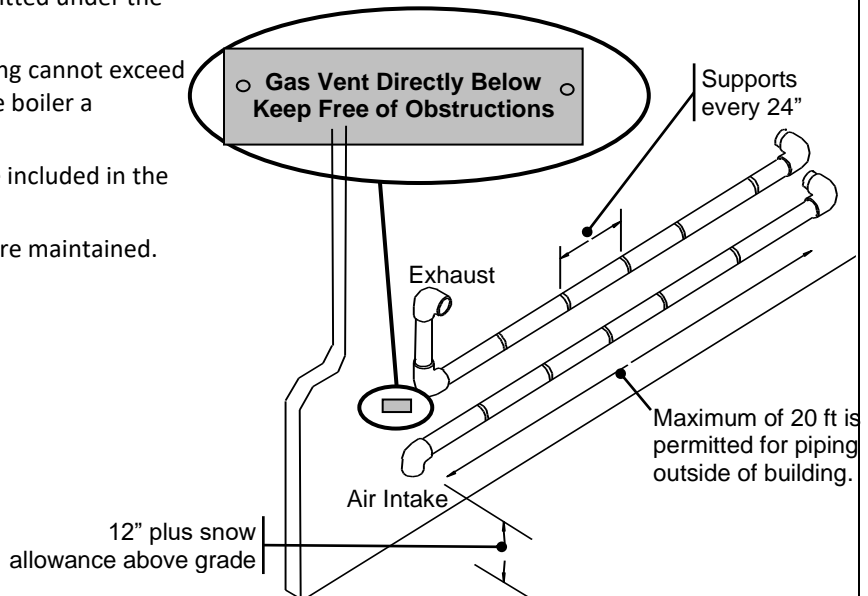
1. Excavate site to a point below where the pipes are to exit as shown.
2. Ensure the wall is fully sealed where the pipes penetrate.
3. The Vent piping MUST be secured to the side of the building above grade, as shown, to provide rigidity.
4. Ensure that the Exhaust & Air-Intake clearances are maintained, see Section [5.0 VENT TERMINATION CLEARANCES](#).



**Figure 4-6 Outdoor Venting**

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

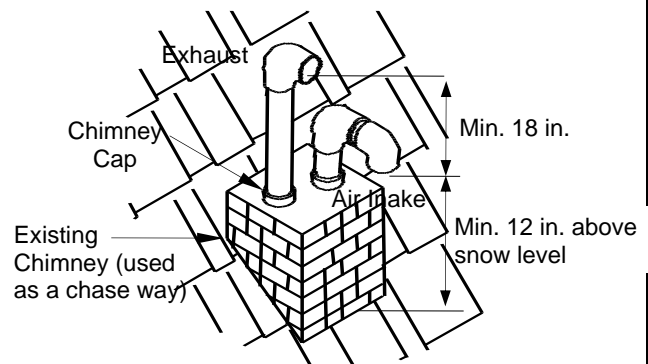
1. Horizontal piping outside the building cannot exceed 20 ft and shall be sloped back to the boiler a minimum of 1/2" per foot.  
**NOTE:** outdoor vent length must be included in the overall vent length calculation.
2. All normal termination clearances are maintained.
3. The pipe is supported every 24".



**Figure 4-7 Existing Chimney Chase Way**

It is permissible to use an existing chimney as a chase way to run the vent piping if:

1. The chimney is not being used by any other boiler.
2. Flue gases do not enter the vacant chimney.
3. Only certified venting materials are used; see Table 4-3.
4. Vent lengths are within the maximums specified; see Tables 4-4 & 4-5.
5. The top of the chimney is capped, and the vent pipes are flashed to prevent leakage into the vacant chimney.



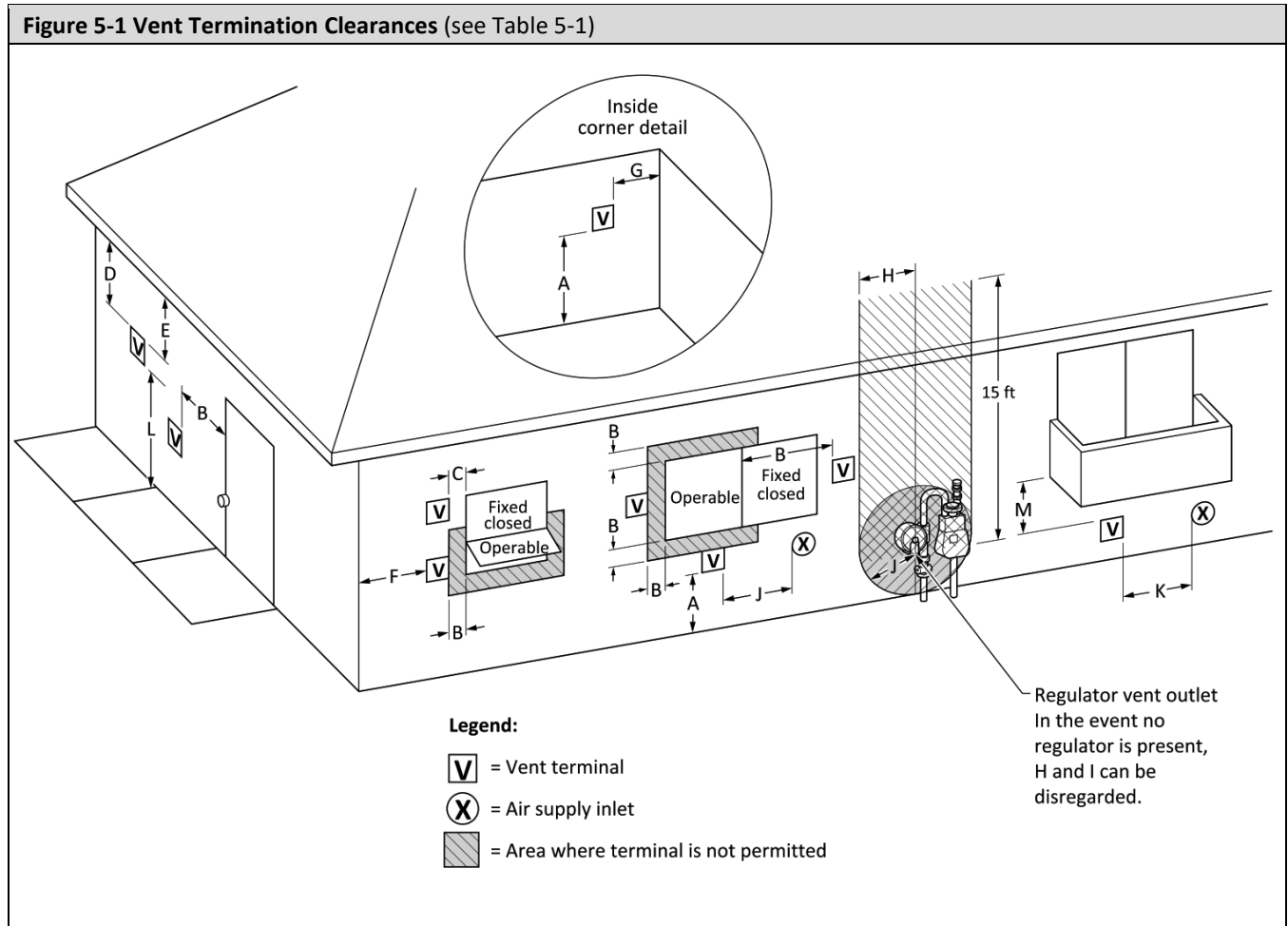
Under no circumstances may an existing chimney or chase-way be used to vent or provide combustion air to a TFTN boiler. Failure to follow these instructions will result in fire, property damage, serious injury or death.

### 5.0 VENT TERMINATION CLEARANCES



The lettered vent termination clearances A through M illustrated in Figure 5-1 are described in Table 5-1; abide by these minimum vent terminal clearances while following the instructions detailed in section 4.0 – GENERAL VENTING. Failure to follow these instructions may result in fire, property damage, serious injury or death.

**NOTE:** Compliance alone does not ensure a satisfactory installation, good common sense must also be applied.



**Table 5-1 Vent Termination Clearances** (see Figure 5-1)

		Canadian installations <sup>1</sup>	US installation <sup>2</sup>
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 <sup>5</sup>	36 in (91 cm)	Direct vent = 12 in (30 cm) Other than direct vent = 4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening
C =	Clearance to permanently closed window	Not applicable	Not applicable
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	6 ft (1.83 m)	6 ft (1.83 m)

(Continued...)

Table 5-1 Vent Termination Clearances (...Continued)

		Canadian installations <sup>1</sup>	US installation <sup>2</sup>
E =	Clearance to unventilated soffit	Not applicable	Not applicable
F =	Clearance to outside corner	Not applicable	Not applicable
G =	Clearance to inside corner	36 in (91 cm)	36 in (91 cm)
H =	Clearance to each side of center line extended above meter/regulator assembly	3 ft (91 cm) within a height 15 ft (4.6 m)	3 ft (91 cm) within a height 15 ft (4.6 m)
I =	Clearance to service regulator vent outlet	3 ft (91 cm)	3 ft (91 cm)
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	36 in (91 cm)	Direct vent = 12 in (30 cm) Other than direct vent = 4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening
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	Vents cannot be located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard	Vents 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 <sup>4</sup>	12 in (30 cm)	12 in (30 cm)

**Notes:**

- 1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code.
- 2) In accordance with the current Z223.1/NFPA 54, National Fuel Gas Code.
- 3) If locally adopted installation codes specify clearances different than those illustrated, then the most stringent clearance shall prevail.
- 4) Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
- 5) Appliances that terminate through an outside wall of a building and discharge flue gases perpendicular to the adjacent wall shall be located not less than 10 ft (3.05 m) horizontally from an operable opening in an adjacent building. This requirement shall not apply to vent terminals that are 2 ft (61 cm) or more above or 25 ft (7.62 m) or more below operable openings.

## 6.0 CONDENSATE DRAIN

This unit produces liquid condensate in the heat exchanger and venting system as a product of combustion. Steps must be taken to ensure condensate does not collect in the venting system; therefore, all exhaust piping must slope back to the boiler a minimum 1/4" per linear foot of vent. Condensate must be drained from the unit into a household drain.

### NOTICE

Check with your municipality, or local gas company, to determine if the disposal of combustion condensate is permitted in your area (e.g., in the **State of Massachusetts** the condensate must be neutralized prior to entering a drain).

The following are important factors that must be taken into consideration when constructing the condensate drain system:

- **DO NOT** install condensate lines outside. A frozen or blocked drain will cause the condensate to back-up and leak. This may result in damage to boiler components resulting in a no heat condition; property damage may also occur.
- **NEVER** use copper, steel, or galvanized piping in the construction of the condensate system (condensate is very corrosive and will corrode most metals).
- When a condensate pump is used or required, select a pump that is designed for residential furnaces.

### CAUTION

All tubing, drains and surfaces that come in contact with condensate draining from the boiler, must be constructed out of corrosion resistant material; copper, steel and galvanized are not acceptable materials for draining condensate. Failure to abide by this caution will result in property damage.

### CAUTION

The Condensate Trap (Siphon) must be periodically disassembled and cleaned as part of a regular maintenance plan. Failure to clean the trap regularly can cause condensate drain blockage leading to boiler malfunction, property damage and even personal injury.

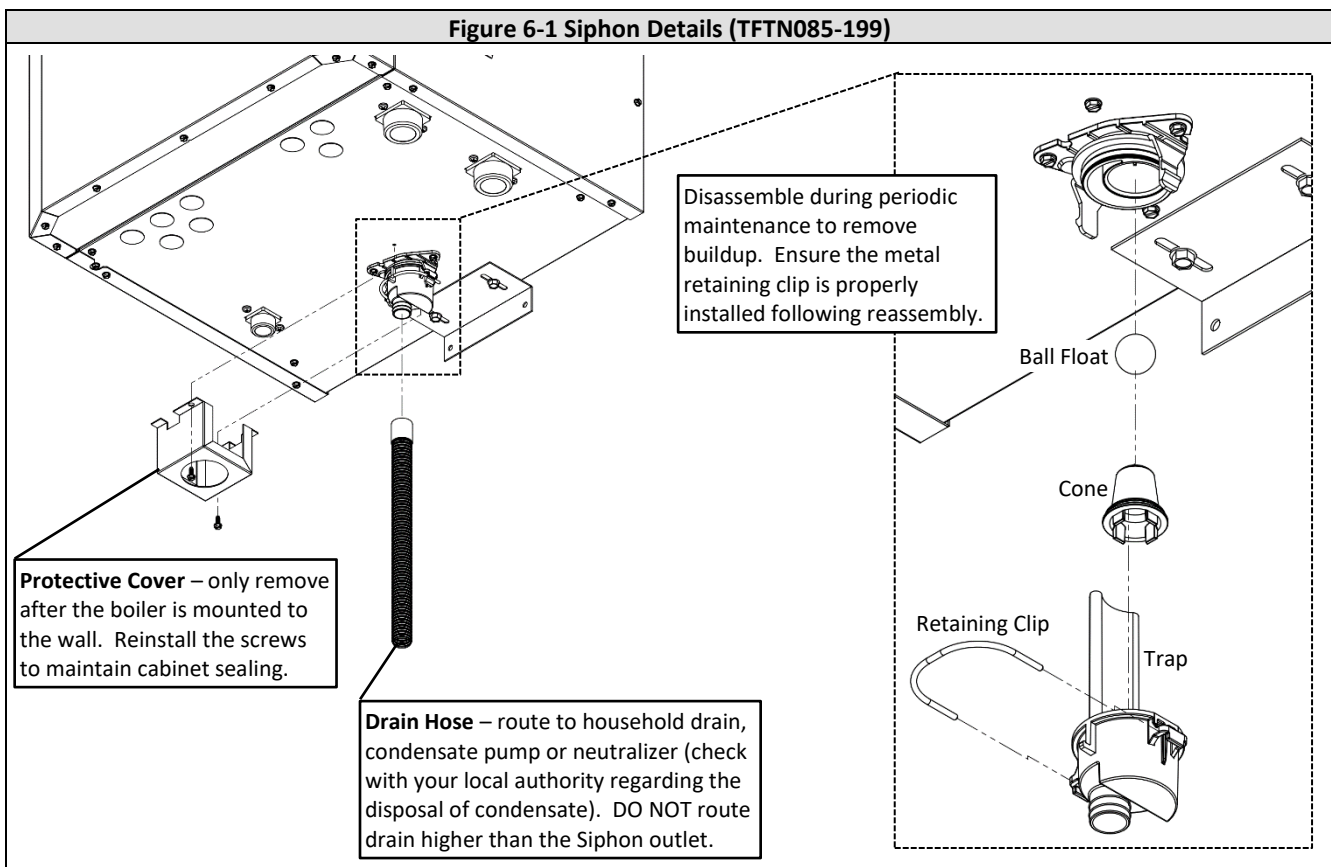
### Condensate Trap (Siphon) Assembly

### DANGER

Ensure the condensate trap is properly assembled (or reassembled following service). An improperly assembled condensate trap could result in flue gas spillage and leeching of carbon monoxide emissions into the surroundings resulting in serious injury or death.

TFTN085-199 models come with the Siphon preassembled and installed in the boiler. The installer only needs to remove the protective cover, inspect the siphon for damage, and connect the included drain hose; see Figure 6-1.

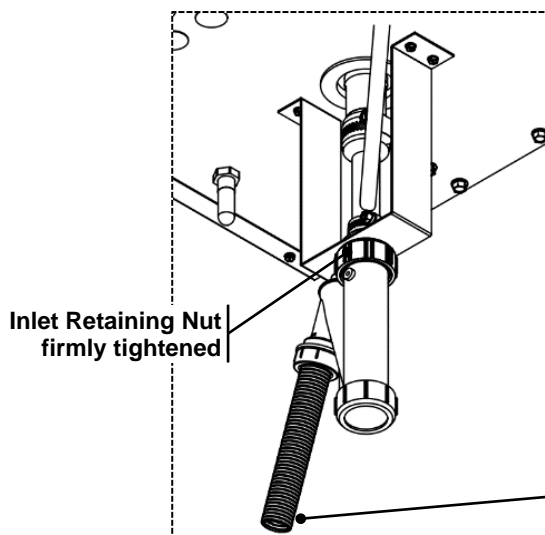
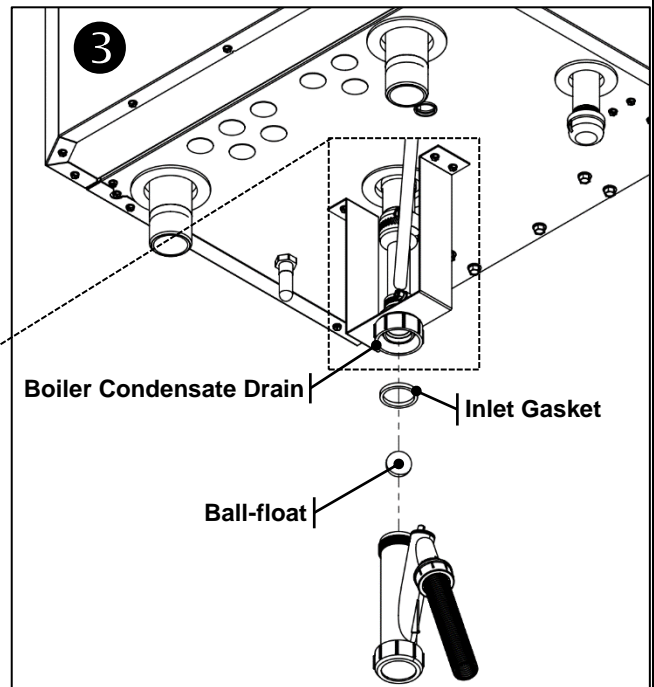
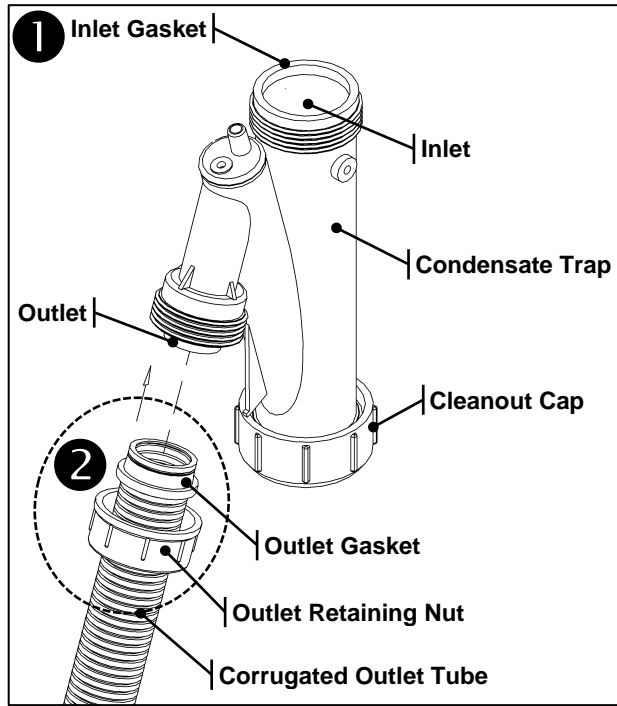
**NOTE:** it is recommended to leave the protective cover in place while mounting the boiler, to avoid damaging the siphon during handling.



For **TFTN285-399** models the Siphon is shipped loose inside the boiler cabinet and must be connected to the bottom of the boiler as described below and in Figure 6-2:

1. **Inspect Siphon** to ensure all parts were shipped with the assembly. The Siphon must be periodically disassembled and cleaned as part of a regular maintenance plan.
2. **Attach Corrugated Outlet Tube** – remove the Outlet Retaining Nut and Outlet Gasket from the Siphon and slide them onto the Corrugated Outlet Tube, maintaining the same orientation (Note: gasket should be positioned approximately 1/8” from the edge of the outlet tube – see Figure 6-2). Press the Corrugated Outlet Tube into the Siphon outlet connection and firmly hand-tighten the Outlet Retaining Nut.
3. **Connect Siphon to Boiler** – ensure the Ball-float is placed inside the Siphon, position the Inlet Gasket between the Siphon and boiler, then firmly hand-tighten the Inlet Retaining Nut to secure the Siphon in place.

Figure 6-2 Siphon Details (TFTN285-399)



**Outlet to Drain**

route to household drain, condensate pump or neutralizer (check with your local authority regarding the disposal of condensate). **DO NOT** route drain higher than the Siphon outlet

## 7.0 INSTALLING GAS PIPING



TFTN boilers are factory set to operate with Natural Gas; **BEFORE OPERATING WITH PROPANE**, the boiler must be converted using the appropriate *Natural Gas to LP Conversion Kit*; see below. Failure to properly convert the unit to safely operate with Propane will cause dangerous burner operation, resulting in property damage, serious injury or death.

**Table 7-1 Natural Gas to LP Conversion Kits**

Boiler Model	Natural Gas to LP Conversion Kit (part no.)
TFTN085-110	87752
TFTN150	87753
TFTN199	87740
TFTN285	87754
TFTN340-399	87755

**Notes:**

- <sup>1</sup> TFTN085-199 models are converted to Propane using a replacement LP-Mixer and Diaphragm insert, which are provided in the respective Natural Gas to LP Conversion Kit; follow the instructions provided in the kit to complete the conversion to LP.
- <sup>2</sup> TFTN285-399 models are converted to Propane by installing an LP-Orifice, which is provided in the respective Natural Gas to LP Conversion Kit; follow the instructions provided in the kit to complete the conversion to LP.



Liquefied Petroleum (LP) propane gas is heavier than air. Do not install the boiler in a pit or similar location that will permit heavier than air gas to collect. Check with Local Codes as they may require boilers fueled with LP gas to be provided with an approved means of removing unburned gases from the room. Failure to follow these instructions may result in serious injury or death.

### Installation

Refer to the current **National Fuel Gas Code ANSI Z223.1/NFPA 54** or **CAN/CGA B149.1** installation codes, and local codes for gas piping requirements and sizing. Pipe size running to the unit depends on:

- Length of pipe.
- Number of fittings.
- Type of gas.
- Maximum input requirement of all gas boilers in the residence.

### Ensure that:

- The gas line connection to the boiler does not apply any weight to the gas valve. NTI recommends using approved flexible gas piping (if acceptable by local codes) to connect the boiler to the gas supply (See Figure 7-1 for details).
- You plan the installation so the piping does not interfere with the vent pipe, or the removal of the valve, burner, and serviceable components.
- The Boiler is installed such that the gas ignition system components are protected from water (dripping, spraying, rain etc.) during installation and servicing.
- The gas piping is large enough for all the gas appliances in the home. No appreciable drop in line pressure should occur when any unit (or combination of units) lights or runs. Use common gas-line sizing practices.
- Always use a pipe-threading compound that is resistant to Propane (LP) gas solvent action. Apply sparingly to all male threads, starting at two threads from the end. Over doping or applying dope to the female end, can result in a blocked gas line.
- **DO NOT TIGHTEN FITTINGS WITHOUT SUPPORTING THE GAS VALVE** as damage to the valve or blower motor can occur.
- Install a manual “Equipment Shut-Off Valve” as shown in Figure 7-1. Valve must be listed by a nationally recognized testing laboratory.
- The gas line piping can safely be removed from the boiler for servicing, by strategically placing the gas line shutoff and union; see example in Figure 7-1.
- All gas piping, including gas components in the boiler, are checked for leaks using a “Bubble Test”, prior to operating the boiler.



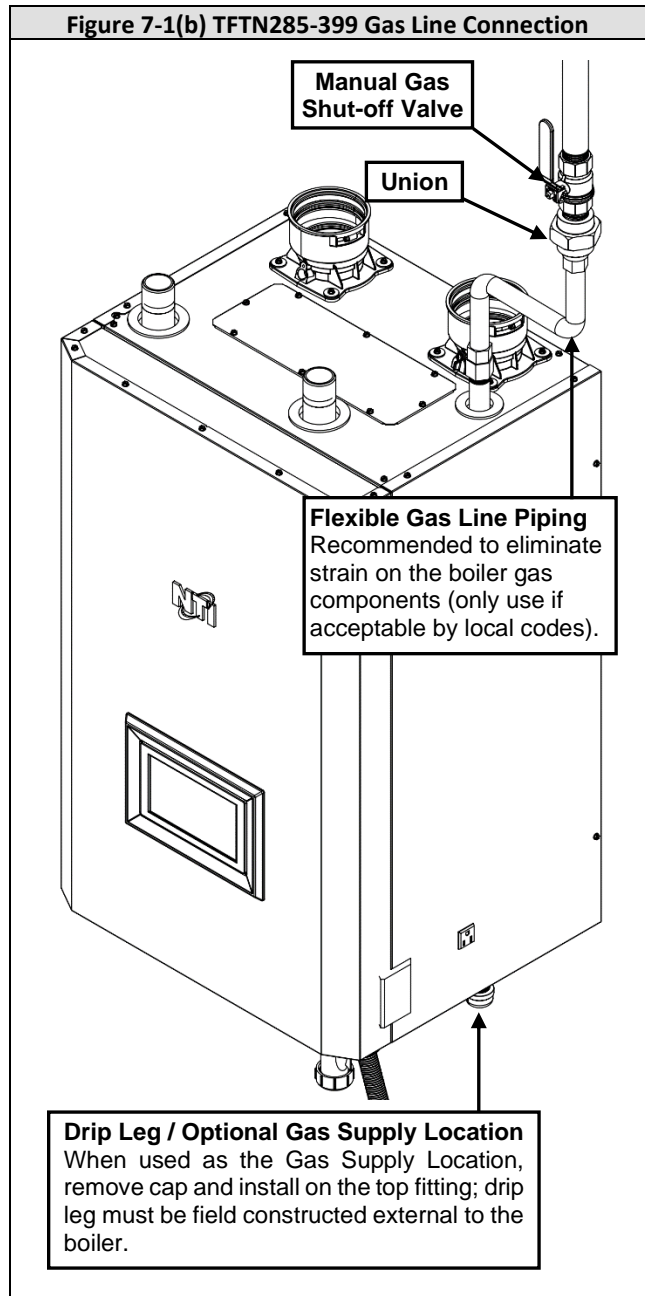
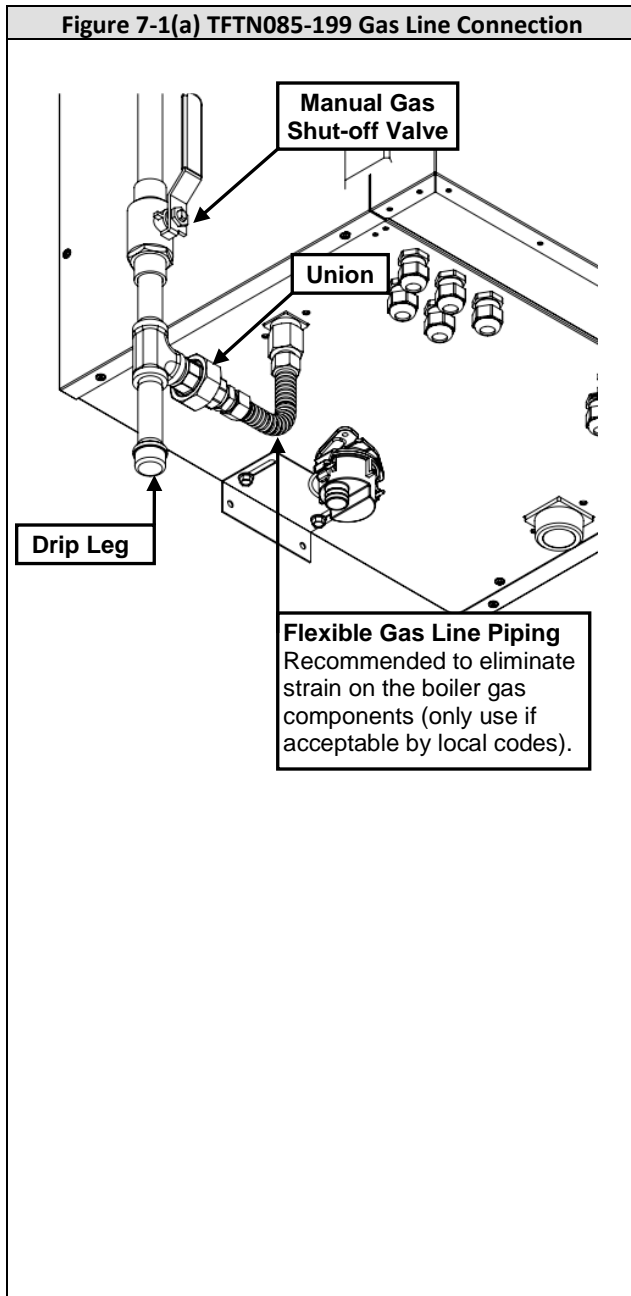
Strain on the gas valve and fittings may result in vibration, premature component failure and leakage and may result in a fire, explosion, property damage, serious injury or death.



Do not use an open flame to test for gas leaks. Failure to follow these instructions may result in fire, property damage, serious injury or death.



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



Apply propane gas compatible pipe sealing compound to the male-end of all threaded connections before assembly. Support boiler gas line connection during assembly of gas piping to prevent damage to internal boiler components. Failure to follow these instructions may result in fire, property damage, serious injury or death.



Test all gas piping, internal and external to the boiler, for leaks. Failure to follow these instructions may result in fire, property damage, serious injury or death.



## 8.0 LIGHTING THE BOILER



Before Start-up refer to **Mandatory Pre-commissioning Procedure for Plastic Venting** in section [4.3 Flammable Solvents and Plastic Piping](#). Failure to follow these instructions can result in explosions, injury, or death.



Prior to turning the gas supply on and lighting the boiler, ensure all aspects of the installation are complete and in conformance with the instructions provided in this manual, including the Exhaust/Air Intake, Condensate Drain, and System Water Piping. Failure to precisely follow these instructions will cause a fire or explosion resulting in property damage, serious injury or death.



Do not store or use gasoline or other flammable vapors & liquids in the vicinity of this or any other boiler. Failure to follow instructions could result in explosion causing property damage, serious injury or death.



If you do not follow these instructions exactly, a fire or explosion may result causing property damage, serious injury or death.



Should overheating occur or the gas supply fails to shutoff, close the Manual Gas Shutoff Valve to the boiler. Failure to follow instructions could result in explosion causing property damage, serious injury or death.

### FOR YOUR SAFETY, READ BEFORE OPERATING

- A) This boiler does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B) BEFORE OPERATING smell all around the boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.  
WHAT TO DO IF YOU SMELL GAS:
  - Do not try to light any boiler.
  - Do not touch any electric switch.
  - Do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- C) Use only your hand to turn the gas "shutoff" valve. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D) Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control which has been under water.

### OPERATING INSTRUCTIONS

1. STOP! Read the safety information above very carefully.
2. Set the thermostat to lowest setting. Turn off all electric power to the boiler.
3. This boiler does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
4. Turn the manual gas valve to the OFF position. Remove front access panel.
5. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above. If you don't smell gas, go to the next step.
6. Turn the manual gas valve ON. Wait an additional five (5) minutes smelling for gas.
7. Replace the front access panel.
8. Set thermostat to highest setting. Turn on all electric power to the boiler.
9. Ignition sequence is automatic. Combustion will occur after a brief fan purge.
10. If ignition does not occur, follow the instructions "To Turn Off Gas To Boiler" and call your service technician or gas supplier.

### TO TURN OFF GAS TO THE BOILER

1. STOP! Read the safety information above very carefully.
2. Turn off all electric power to the boiler
3. Turn the manual gas valve to the OFF position



The initial lighting of the boiler must be performed by a licensed Gas Technician. Failure to follow instructions may result in property damage, serious injury or death.

- Ensure the boiler is wired in accordance with this manual.
- Ensure the gas shutoff valve is turned on, and that the gas system has been fully tested for leaks.
- Ensure the system is filled with water, and that ALL the air is purged out.
- Ensure the Exhaust and Air Intake piping is completely installed in accordance with this manual.



Allow primers/cements to cure for 8 hours prior to Start-up. If curing time is less than 8 hours, first perform Steps 2 through 6 of **Mandatory Pre-commissioning Procedure for Plastic Venting** in section [4.3 Flammable Solvents and Plastic Piping](#). Failure to follow these instructions can result in explosion, serious injury or death.

## Initial Start-Up

1. Turn on power to the boiler and turn-up the Thermostat(s). The boiler should run through a purge, and combustion should occur. (The control system has a built-in ignition retry, allowing the system to try two three times before locking out.)
2. With the unit operating at Max Power (100%), verify that the gas line pressure is 3.5-10.5" WC for Natural gas, and 8-13" WC for Propane (See section [9.0 GAS VALVE AND BURNER SET-UP](#) for details).
3. Using an appropriate Oxygen (O<sub>2</sub>) or Carbon Dioxide (CO<sub>2</sub>) analyzer, take a sample of the flue gas. The sample must fall within the acceptable ranges for CO<sub>2</sub> specified in Table 9-1.
4. Perform at least three ignitions in succession to ensure proper operation.
5. After the three successive ignitions, unplug the flame detection electrode, and allow the unit to cycle again. The flame safety system will allow the unit to go through 2 ignition cycles before going to "Fault 501 – No Flame detected". Once you have confirmed this behavior, reinstall the wire on the electrode, reset the Lockout and reconfirm proper lighting.



The flame detection electrode is located in the burner plate; it has a single black wire connected to it. DO NOT remove the red spark cable from the ignition electrode (also located in the burner plate); this device is used for spark ignition and produces 14,000 volts potential which would result in an EXTREME ELECTRICAL SHOCK possibly causing serious injury or death.



If the unit fails to light consistently and smoothly, contact NTI for technical assistance at 1-800-688-2575. Never allow the boiler to operate if the ignition or operation of the burner is rough or erratic. Failure to follow these instructions may result in serious injury or death.

## Re-lighting Unit

1. Stop and read these instructions very carefully.
2. Set the thermostat to the lowest setting, and then turn off all power to the boiler.
3. This boiler does not have a pilot. It is equipped with an ignition device that automatically lights the burner. Do not try to light the burner by hand.
4. Turn the gas shutoff valve to the off position, and then remove the front cover.
5. Wait five (5) minutes to clear out any gas. Then check for gas, including near the floor. If you smell gas "Stop" and follow "B" above (see **FOR YOUR SAFETY, READ BEFORE OPERATING**). If you do not detect any gas proceed to the next step.
6. Turn the gas shutoff valve to the on position, wait an addition five (5) minutes and check for gas.
7. Replace the front cover.
8. Set the thermostat to the highest setting, and then turn on all power to the boiler.
9. Ignition sequence is automatic, combustion will occur after a brief fan purge. Ignition will retry 3 times.
10. If ignition does not occur, "Turn off the gas and electricity to the boiler" and contact a qualified service technician, or gas supplier.

## Turning Off the Boiler

1. Set the thermostat to the lowest setting, and then turn off all power to the boiler.
2. Turn the gas shutoff valve to the off position.

## 9.0 GAS VALVE AND BURNER SET-UP



Set-up of the TFTN gas valve must be performed by a licensed Gas Technician. Failure to perform the set-up correctly may result in incorrect operation, component failure, property damage, serious injury or death.

### Combustion Calibration Procedure

To calibrate burner combustion, perform the following procedure using a calibrated combustion analyzer capable of measuring CO<sub>2</sub> and CO from a Natural Gas or Propane burning appliance:

1. **Set analyzer** to the appropriate fuel (Natural Gas or Propane).
2. **Gas Line Pressure Test** – monitor gas line pressure throughout all combustion tests and verify it is maintained within tolerance. See *Gas Line Pressure Test* below.
3. **Set Throttle Screw** – with the burner operating at Max Power (100%); set combustion according to Table 9-1 using the Throttle Screw; allow time for the analyzer readings to stabilize between adjustments – record CO<sub>2</sub> value. See *Throttle Screw Adjustment* section below.
4. **Set Offset Screw** – with the burner operating at Min Power (10%); using the Offset Screw, set the CO<sub>2</sub> in accordance with Table 9-1, i.e., 0.4-0.8% lower than the value obtained during the Max Power test for models TFTN285-399, and 0.2-1.0% lower than the value obtained during the Max Power test for models TFTN085-199. See *Offset Screw Adjustment* section below.



**Combustion Calibration is mandatory** upon installation and during each annual service. Failure to perform the Combustion Calibration in accordance with these instructions may result in incorrect combustion leading to burner damage or excessive Carbon Monoxide concentrations causing property damage, personal injury, or death.



**Carbon Monoxide** - Never leave the unit operating while producing Carbon Monoxide (CO) concentrations more than 175 ppm. Failure to follow this warning may result in serious injury or death.

### Throttle Screw Adjustment

The gas valve Throttle Screw (see Figures 9-2 and 9-3) is used to calibrate the CO<sub>2</sub> concentration with the burner operating at Max Power (100%).

**TFTN285-399** – turning the Throttle Screw in (clockwise) decreases the CO<sub>2</sub> concentration, while turning it out (counterclockwise) increases the CO<sub>2</sub> concentration. Adjust in increments of 1/16<sup>th</sup> of a turn, wait 1 minute after each adjustment to allow combustion readings to stabilize.

**NOTE:** when switching direction between clockwise and counterclockwise, it may take a half to a full turn before a change in CO<sub>2</sub> is realized.

**TFTN085-199** – Throttle Screw is a left-hand thread; therefore, turning the Throttle Screw counterclockwise turns it in, and decreases the CO<sub>2</sub> concentration (i.e., opposite to TFTN285-399 models). Turning the TFTN085-199 Throttle Screw clockwise turns it out, and therefore increases the CO<sub>2</sub> concentration. Typical adjustment required is 0 – 2 turns in or out from the factory setting, wait 1 minute after each adjustment to allow combustion readings to stabilize.

**NOTE:** The modulation rate can be manually adjusted while in firing rate Test Mode – see Figure 9-1.



Adjustments to the **Throttle Screw** may only be made by a qualified gas technician using a calibrated combustion analyzer capable of measuring CO<sub>2</sub> and CO. Adjustments may only be performed if the gas line pressure is maintained above minimum levels throughout the duration of the test (see Table 9-1). Failure to follow these instructions may result in serious injury or death.

### Offset Screw Adjustment

The gas valve Offset Screw (see Figures 9-2 & 9-3) is used to calibrate the CO<sub>2</sub> offset at Min Power (10%) vs. Max Power (100%). Turning the Offset Screw in (clockwise) increases the CO<sub>2</sub> concentration at Min Power (10%). Turning the Offset Screw out (counterclockwise) decreases the CO<sub>2</sub> concentration at Min Power (10%). Typical adjustment required is 0 - 1/4 of a turn in or out from the factory setting.

**NOTE:** Calibration of the Offset Screw must only be performed with the burner operating at Min Power (10%).

**NOTE:** The modulation rate can be manually adjusted while in firing rate Test Mode – see Figure 9-1.

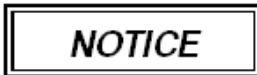


Adjustments to the **Offset Screw** may only be made by a qualified gas technician using a calibrated combustion analyzer capable of measuring CO<sub>2</sub> and CO, and only with the burner operating at Min Power (10%). Attempting to set the Offset Screw while the burner is operating above Min Power will result in incorrect combustion and may lead to burner damage or excessive CO.

### Gas Line Pressure Test

The boiler gas valve is equipped with a line pressure test port; see Figures 9-2 & 9-3. Use the following procedure to measure the gas line pressure to the boiler to ensure it falls within the range given in Table 9-1:

1. Turn the supply of gas to the boiler off.
2. Open the bleed screw of the line pressure test port approximately 1-1/2 turns. This port is directly connected to the gas line feeding the boiler. See Figures 9-2 & 9-3.
3. Force 1/4" ID tubing over the housing of the line pressure test port; install the other end of the tubing to an appropriate line pressure test gauge or manometer. Ensure both ends of the tubing make a tight connection.
4. Open the supply of gas to the boiler and check for gas leaks.
5. Observe the line pressure under static conditions and compare it to Table 9-1. The pressure will be greatest under static conditions.
6. With all other gas appliances in the application running, operate the burner at Max Power (100%) and compare the observed line pressure with Table 9-1. The pressure will be lowest during the maximum flow of gas.
7. Adjust the gas line pressure to ensure the parameters in Table 9-1 are attained under all conditions. If possible, adjust the line pressure to middle of the range listed in Table 9-1, while the unit is operating at Max Power (100%).
8. Continue observing the gas line pressure until the completion of the combustion analyses in case adjustments need to be made.
9. Complete pressure testing, and then return the bleed screw of the Line Pressure Test Port to the closed position.



The line pressure is a function of the gas supply and is affected solely by field provided parameters such as line size and regulator settings. Under no circumstances can the boiler gas valve influence or be used to adjust the gas line pressure.



Failure to close the bleed screw of the Line Pressure Test Port will cause a severe leakage of gas, resulting in a fire or explosion causing property damage, serious injury or death.

**Table 9-1 Combustion Parameters and Gas Line Pressure**

Model	Natural Gas				Propane			
	CO <sub>2</sub>		CO	Line Pressure	CO <sub>2</sub>		CO	Line Pressure
	Max Power (100%)	Min Power (10%)			Max Power (100%)	Min Power (10%)		
85-199	8.7-10.0%	8.5-9.8%	<175ppm	3.5-10.5" WC	9.7-11.0%	9.5-10.8%	<175ppm	8-13" WC
285-399	8.9-10.0%	8.5-9.6%	<175ppm	3.5-10.5" WC	9.9-11.0%	9.5-10.6%	<175ppm	8-13" WC

**Notes:**

- <sup>1</sup> TFTN085-199 models – the CO<sub>2</sub> at Min Power (10%) must be set lower than the CO<sub>2</sub> at Max Power (100%) by 0.2-1.0%
- <sup>2</sup> TFTN285-399 models – the CO<sub>2</sub> at Min Power (10%) must be set lower than the CO<sub>2</sub> at Max Power (100%) by 0.4-0.8%

Figure 9-1 Placing the Boiler in Firing Rate Test Mode

**1** Select **Setup** from the home screen

**2** Select **Test Mode** from the Setup menu  
**Note:** if prompted, you will need to enter the password, “ntinet”, see section [16.3.1 Setup Wizard](#).

**3** Select **Burner Test** from the Test Mode screen

**4** Select **Max Power** from the Burner Test screen

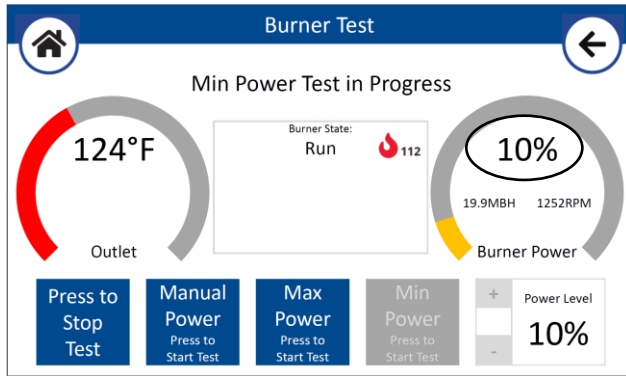
**5** Verify Burner Power goes to 100% before proceeding with Max Power combustion calibration (see Table 9-1).  
**Note:** Use the Throttle Screw to adjust Max Power combustion – see Figure 9-2.  
**Note:** Verify gas line pressure to unit is within range while operating at Max Power – see Table 9-1.

**6** Upon completing Max Power calibration, select **Min Power** from the Burner Test screen.

**Note:** If the Burner Power gauge and Power Level are flashing, it means that the Power Limiting function is active, and the burner power will not exceed 50%. The Power Limiting function finishes after 5min of normal burner operation.

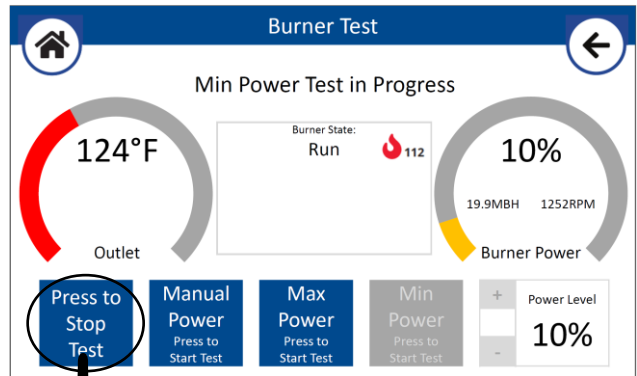
(Continued...)

Figure 9-1 Placing the Boiler in Firing Rate Test Mode (...Concluded)



7 Verify Burner Power goes to 10% before proceeding with Min Power combustion calibration (see Table 9-1).

Note: Use the Offset Screw to adjust Min Power combustion – see Figure 9-2.



8 Select **Press to Stop Test** upon completing the combustion calibration procedure. Proceed to other menus by selecting the Home or Back buttons.

Figure 9-2 TFTN085-199 Gas Valve Adjustment

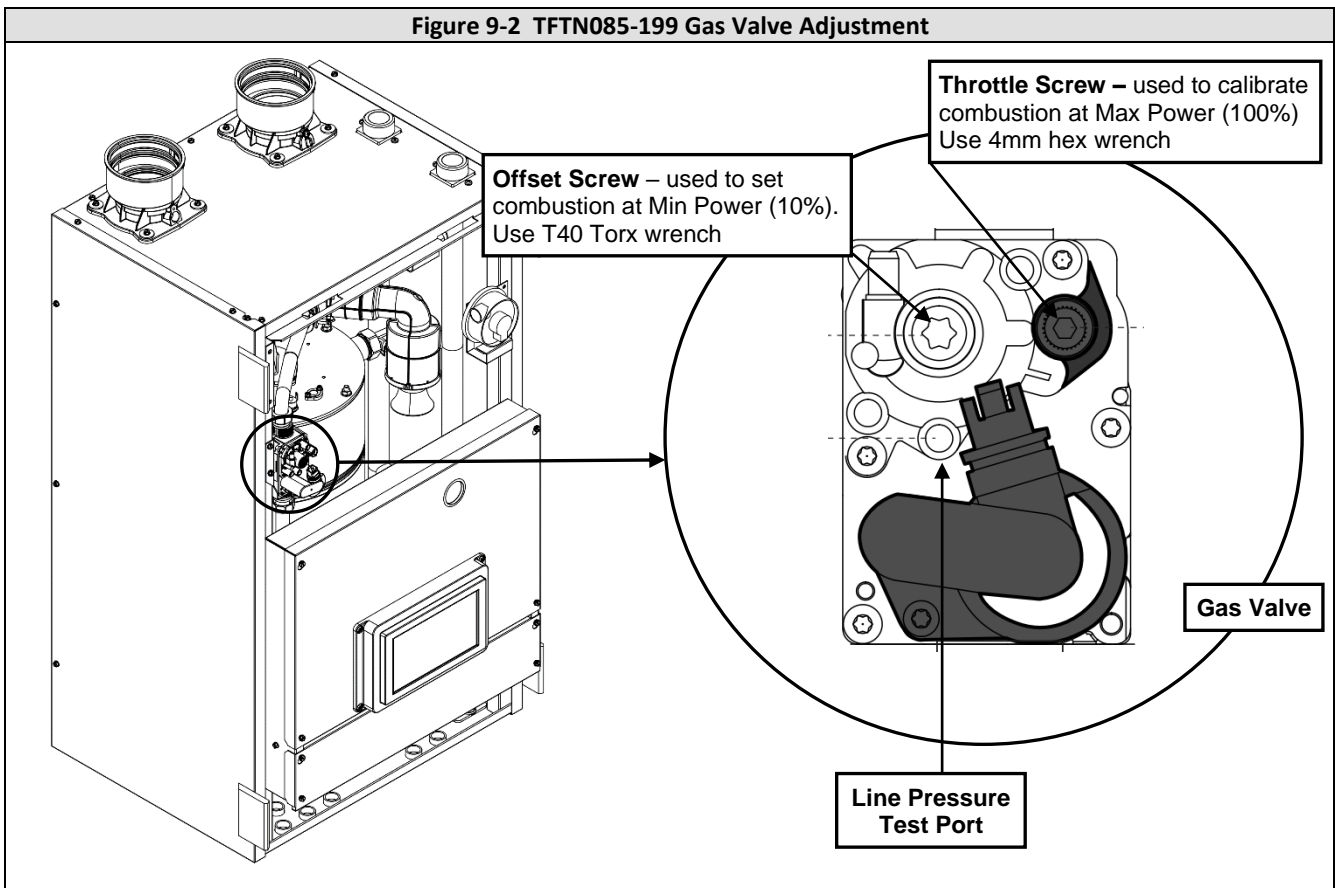
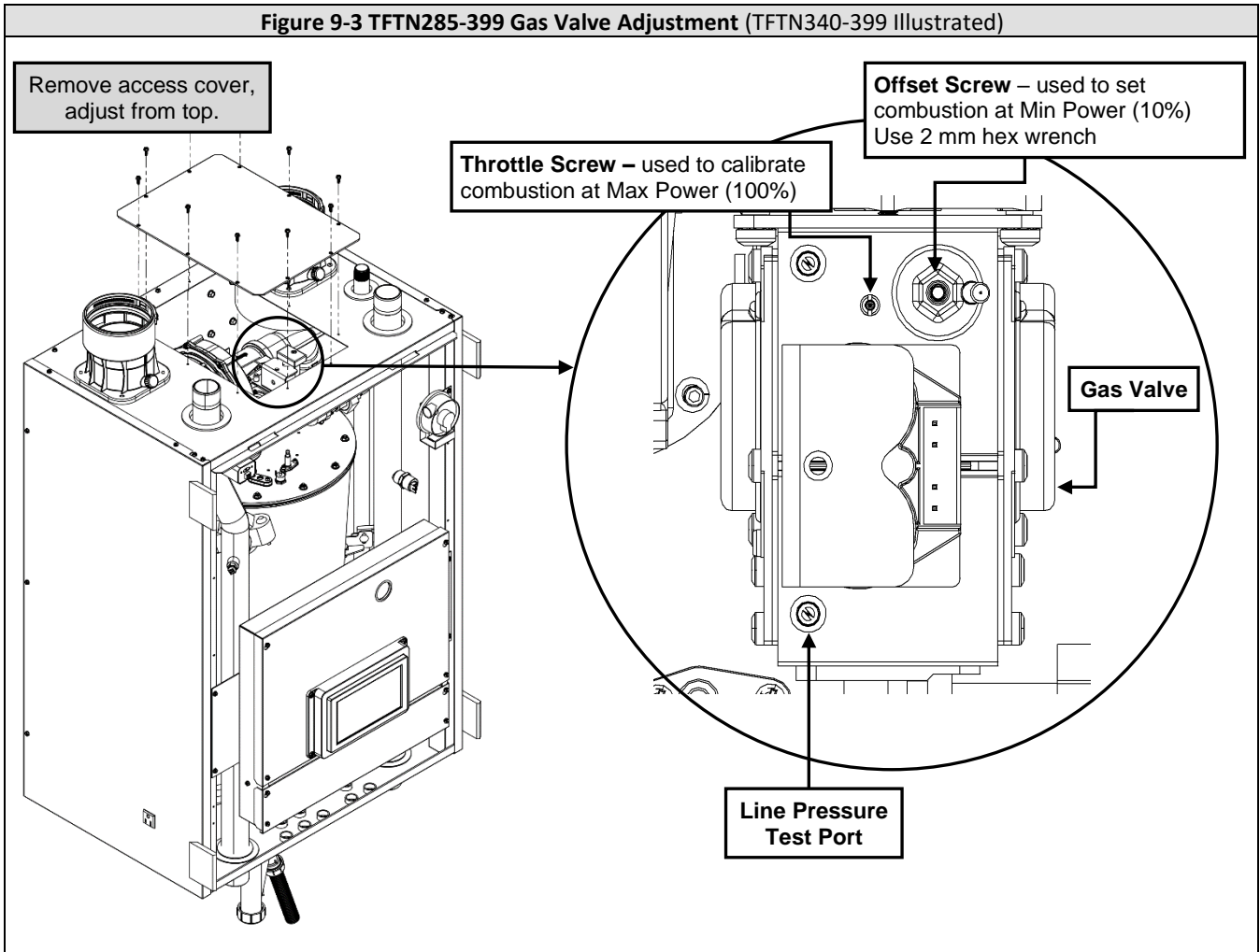


Figure 9-3 TFTN285-399 Gas Valve Adjustment (TFTN340-399 Illustrated)



## 10.0 BOILER AND HEATING SYSTEM PIPING

The fire tube design of the TFTN heat exchanger results in minimal head loss, however it must be considered when sizing system piping and circulators. Furthermore, the low mass of the TFTN heat exchanger requires a minimum flow rate anytime the burner is operating. To maintain efficient and reliable operation of the heat exchanger, and to avoid heat exchanger failure, it is critical to ensure the rules and guidelines in this section are followed.



### WARNING

Failure to follow the instructions provided in this section will void the NTI warranty and may result in property damage, fire, serious injury or death.

### 10.1 Water Quality

Water Quality is important to the proper operation and lifespan of the boiler; the information on water quality provided in this document must be followed. Damage caused by failure to follow these requirements will not be covered by the warranty.

During installation and yearly maintenance, the water quality must be checked. Common water quality heat exchanger failures are easily prevented when properly addressed.

Follow these system water best practices:

- Test system fill water and understand what you are putting into the system.
- Ensure that there is adequate air elimination in the system.
- Treat all boiler feed water as though it is hard water.
- Use chemical inhibitors on every job.
- Flush old and new systems with fresh clean water before commissioning a new boiler.
- Use magnetic dirt separators on systems containing large amounts of iron.
- Use Dirt Separators to remove debris from system water.
- Where possible, treat boiler feed water.
- Repair system leaks immediately to prevent oxygen (air) and untreated water from entering the system.

Proper equipment must be used to test the water. Digital meters are highly recommended because they can be calibrated. The use of test strips is not recommended because they degrade over time and can be influenced by many factors.

**System Cleaning** – Existing and new heating systems must be cleaned with a hydronic system cleaner; see list of recommended hydronic system cleaners below; equivalent products from other manufacturers may also be used. System cleaner must be drained and thoroughly flushed with clean water to remove any residual cleaner, prior to installing a new boiler. NEVER leave a system cleaner for longer than recommended by the manufacturer of the cleaner; follow the instructions provided by the system cleaner manufacturer.

- Noble Noburst Hydronic System Cleaner
- Fernox F3 Cleaner
- Rhomar Hydro-Solv 9100
- Sentinel X400

**Air Elimination** – A micro bubble air elimination device must be installed on every boiler installation. Automatic air-vents alone are not an acceptable substitute for a micro bubble air elimination device. Below are a few examples of acceptable devices.

- Spirovent
- Taco 4900 series
- Caleffi Discal

Automatic feed valves should not be left open indefinitely. In the event of a leak, an automatic feed valve will continue to supply fresh untreated water into the heating system. Fresh water contains both oxygen and added minerals, either of these could lead to scaling and/or corrosion of the heat exchanger.

**Dirt Removal** – A dirt removal device should be installed in all systems. In older systems containing cast iron radiators/baseboard or large amount black iron or steel pipe a magnetic dirt separator must be installed.



**Glycol, Snow Melt, and Oxygen Permeable Piping** – When freeze protection is required, only multi metal inhibited propylene glycol, at a minimum of 20% and a maximum of 50%, is allowed for use with boiler system. If the boiler is being used with a snow melt system that requires a concentration of glycol higher than 50%, then a plate heat exchanger is required to separate the snow melt system from the boiler water. Note: the use of glycol may reduce the usable output capacity of the boiler, thus requiring the unit to be “down-fired” by limiting the maximum operating capacity and/or the maximum water temperature. If oxygen permeable piping (non-oxygen barrier tubing) is used in the system a plate heat exchanger is required to separate it from the boiler water.

**NOTICE**

Ethylene glycol is prohibited for use with the boiler, only inhibited propylene glycol is allowed for use with the boiler.

**Water Treatment** – When filling the boiler system, the water must be tested. Table 10-1 outlines the parameters that should be tested for, and the corresponding ranges that are permitted. Water quality that does not fall within the stated ranges will void the warranty of the boiler. Utilize proper testing equipment, such as digital meters, to verify water quality.

**NOTICE**

Never use petroleum-based compounds in the system for cleaning or sealing.

Inhibitors should be used for all installations in both new and existing heating systems. Follow the instructions provided by the inhibitor manufacturer when adding it to the system to ensure the correct concentration. A list of approved inhibitors is provided below.

- Rhomar Pro-tek 922
- Sentinel X100
- Fernox Protector F1

**Table 10-1 Water Condition**

Parameter	Range	Information
pH	7 to 9	The total pH scale ranges from 1 to 14, with 7 considered to be neutral. A pH less than 7 is said to be acidic and solutions with a pH greater than 7 are basic or alkaline.
Conductivity	100 to 300 µS/cm	Conductivity is an indirect method of determining the total dissolved solids in the water. High conductivity in <i>untreated</i> water indicates hard water. Adding corrosion inhibitors will increase conductivity.
Hardness	50 to 120 ppm (3 to 7 gr/gal)	Artificially soft water can damage the system. The use of un-softened water is recommended. Do <b>not</b> use distilled or purified water.
Chlorine	150 ppm	High Chlorine content in the water can damage the boilers heat exchanger.
Glycol (if applicable)	20-50%	Concentrations below 20% can promote bacteria growth, and concentrations above 50% will dramatically reduce efficiency and may require de-rating the boiler. Inhibited glycol mixed at 50% should have a pH 8-9. Check with glycol manufacturer.
Total Dissolved Solids (TDS)	50 to 300 ppm	TDS includes calcium and magnesium associated with lime scale but also includes other harmful solids such as magnetite, chlorides, sodium, and other organic and inorganic materials.
Bacteria/Mold	none	Glycol above 20% will kill any bacteria.
Molybdate Corrosion Inhibitor	100 to 300 ppm	Film-forming inhibitor that protects against iron corrosion.

## 10.2 Near Boiler Plumbing

TFTN boilers are intended solely for use in pressurized closed-loop heating systems operating with a minimum pressure of 12 PSI at the boiler outlet. Carefully follow the instructions and piping diagrams illustrated in this section.

### NOTICE

The TFTN boiler is NOT approved for operation in an “open system”, thus it cannot be used for direct potable water heating or process heating of any kind.

**Pressure Relief Valve** – A 30 PSI Pressure Relief Valve is factory supplied with each unit, and must be field installed in the vertical position, with the outlet facing horizontally and piped towards the floor away from where it could be harmful; see Figure 10-1 for recommended location.

**Note:** TFTN085-199 models have a maximum allowable operating pressure of 50 PSI. The maximum allowable operating pressure of TFTN285-399 models is 80 PSI

### CAUTION

If installed in the incorrect orientation (e.g., horizontally with drain pipe out the bottom) the relief valve may not function properly resulting in property damage or personal injury.

### WARNING

Ensure the discharge of the pressure relief is piped to a location where the steam or water will not cause property damage or serious injury.

**Pressure & Temperature Gauge** – TFTN units come with a factory supplied Pressure and Temperature Gauge. The gauge must be installed at the boiler outlet prior to any circulators.

**Auto Air Vent** – Install the factory supplied auto air vent directly above the outlet fitting on the top of the unit; see Figure 10-1. Open the auto air vent’s vent-cap to promote the removal of air during commissioning of the boiler and to avoid malfunctioning of the LWCO. Once the air is removed from the system, close the vent-cap to prevent water from leaking onto the boiler.

**Low Water Cutoff (LWCO)** – TFTN boilers are provided with a factory installed LWCO switch which incorporates a Test Button and Power and Low Water indicator lights. Perform the following Operational Test Procedure before placing the boiler in service, and ensure Maintenance is carried out with the following schedule.

### WARNING

Do not run the boiler unattended until the following procedure is completed. Failure to follow this procedure may lead to unsafe boiler operation resulting in fire, property damage and loss of life.

### Operational Test Procedure (LWCO)

1. Before introducing water to the boiler, turn the power on; both the green “POWER” LED and amber “LOW WATER” LED should illuminate. Generate a burner demand; the burner should not fire and error “LWCO Open” should appear on the screen. Contact NTI for assistance if this does not happen.
2. Fill the boiler with water; the “LOW WATER” LED should turn off. Press the TEST/RESET button on the LWCO to reset the circuit – burner should now fire.
3. With the burner firing, press the TEST/RESET button to simulate a low water condition; the amber “LOW WATER” LED should illuminate, and the burner should turn off.

### Maintenance (LWCO)

- Every Year – perform Step 3 from the Operational Test Procedure above.
- Every 5-years – Remove the LWCO and clean all surfaces in contact with water.

Figure 10-1(a) Near Boiler Piping (TFTN085-199)

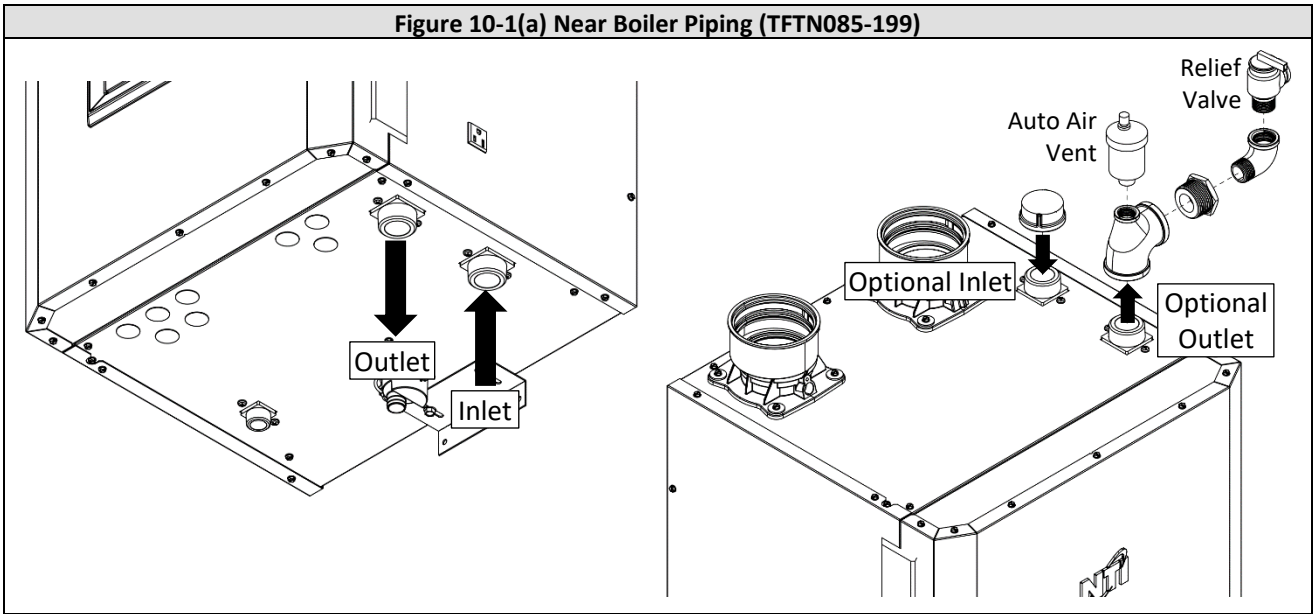


Figure 10-1(b) Near Boiler Piping (TFTN285)

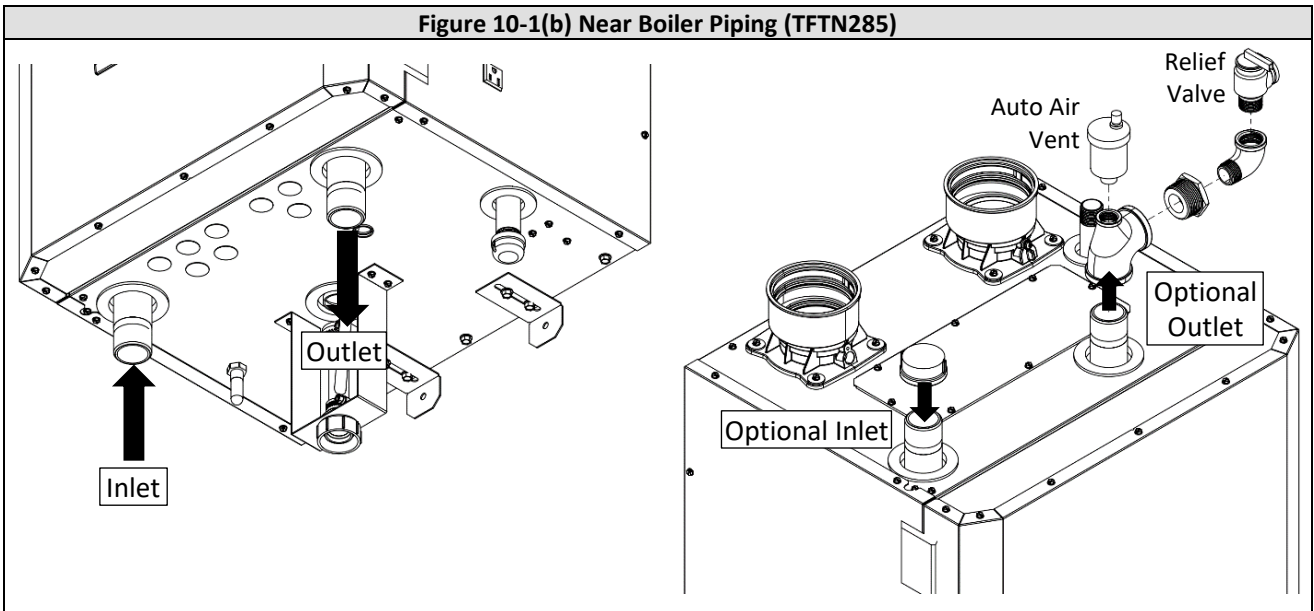
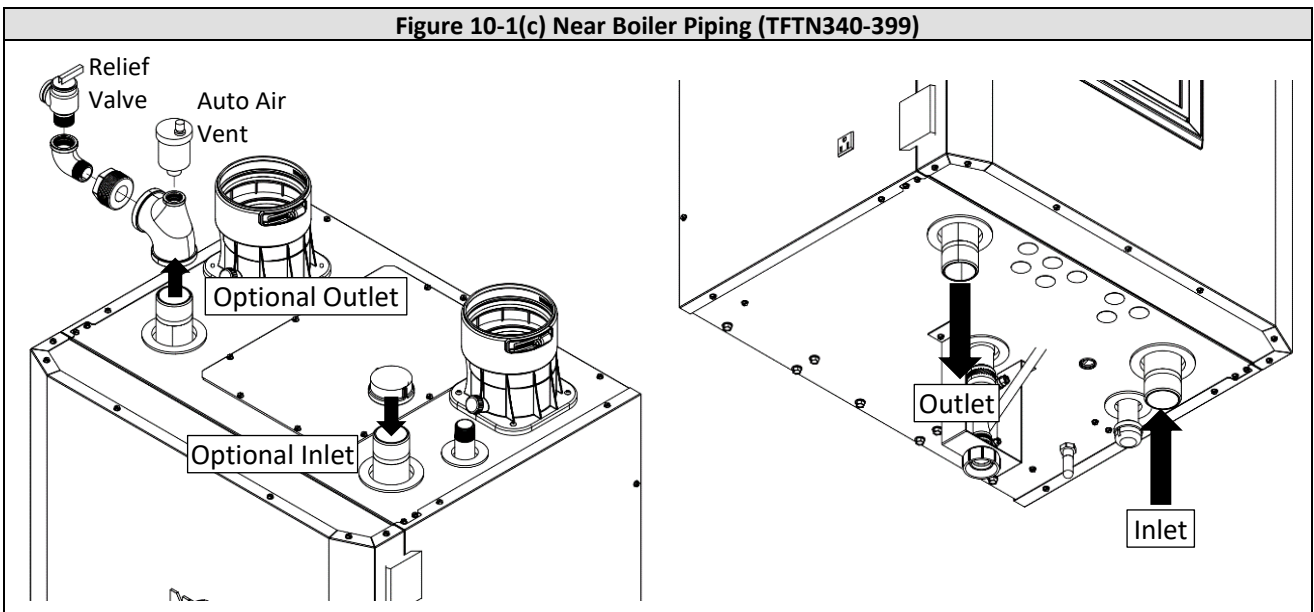


Figure 10-1(c) Near Boiler Piping (TFTN340-399)



### 10.3 Boiler System Plumbing

The TFTN boiler uses a low mass heat exchanger that requires a minimum rate of forced water circulation any time the burner is operating (See Table 10-2 for minimum flow rate requirements). To ensure the minimum flow rate is attained, NTI strongly recommends installing the boiler in a “Primary/Secondary” plumbing configuration utilizing “Closely Spaced Tees” or a “Low Loss Header” to de-couple the Boiler-Primary loop from the System-Secondary loop(s). See the examples of Primary/Secondary Loop configurations in Figures 10-3 through 10-10.

**Table 10-2 Minimum Flow Rate Requirements (at Max Power)**

Model	Flow (US gpm)	Model	Flow (US gpm)
TFTN085	3.5	TFTN285	11
TFTN110	4.4	TFTN340	13
TFTN150	6	TFTN399	15
TFTN199	8		



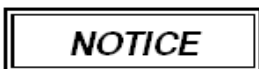
Failure to ensure the minimum water flow rate through the boiler when the burner is operating will result in “short-cycling”, reduced performance and operating efficiency, and may also cause overheating and premature failure which will void the warranty. Failure to follow instructions may result in fire, property damage, serious injury or death.

**Circulator Pump Outputs** – TFTN boilers are equipped with four (4) dedicated 120VAC pump outputs:

1. BLR PUMP – operates during CH, DHW or Buffer Tank demands.
2. DHW PUMP – operates during DHW demand only.
3. AUX1 PUMP – configurable as None, System Pump, DHW Recirc (pump), Buffer Tank (pump), or Cascade Pump via parameter Auxiliary Pump 1 Selection (24.7.0). Default setting = None
  - When configured as System Pump, the operation of the output is dependent on the setting of parameter System Pump Activation Logic (24.4.6); when set to CH Only, the output only turns on during CH demands. When set to Always Active, the output will also turn on during DHW demands if DHW Mode (24.5.2/24.5.3) is configured as Downstream IWH (24.5.2 = Tank Sensor or Aquastat and 24.5.3 = CH Only).
  - When configured as DHW Recirc, the output turns on when the DHW Recirc temperature drops below the DHW Recirc Setpoint (24.20.5/24.20.6).
  - When configured as Buffer Tank, the output turns on when the buffer tank temperature drops below the Buffer Setpoint (20.0.3) if Buffer Tank Function (20.0.0/20.0.7) is set to Fixed or Variable Temperature.
  - When configured as Cascade Pump, the output turns on when the boiler is commanded to serve the cascade system (i.e., cascade CH/DHW). Only applicable for a cascaded boiler that is also connected to an Upstream IWH; see Figure 11-1(a)(b)(c)
4. AUX2 PUMP – configurable as None, System Pump, DHW Recirc (pump), Buffer Tank (pump), or Cascade Pump via parameter Auxiliary Pump 2 Selection (24.7.1). See AUX1 PUMP for description of how output functions. Default setting = System Pump.

**NOTE:** Buffer Tank and DHW Recirc temperature inputs connect to the boiler at sensor inputs *AUX1 NTC* and *AUX2 NTC*, which are configured via parameters Auxiliary Sensor 1 (24.6.1) and Auxiliary Sensor 2 (24.6.2).

**NOTE:** Use of these circulator outputs will depend on the system configuration selected; see Figures 10-3 through 10-10. For further pump output details and wiring instructions see Section [12.0 FIELD WIRING](#).



Circulators responsible for forcing water flow through the boiler must be sized to account for the head loss of the boiler and boiler piping at the required flow rate; see Table 10-3 and Figure 10-2.

**Zone Outputs** – the TFTN is also equipped with three (3) zone outputs (*ZONE 1*, *ZONE 2* & *ZONE 3*), each activating when the respective zone’s room thermostat calls for heat (via inputs *T-STAT #1*, *T-STAT #2* & *T-STAT #3*). The zone outputs deliver the power that is applied to terminal *ZONE INPUT* (see Figures 10-3 through 10-10). Each output is protected with a 5 Amp fuse.

**NOTE:** when supplying terminal *ZONE INPUT* with 24VAC from the boiler’s 24V Supply (as depicted in Figures 10-3,4,5,10), the circuit is further protected by the 2 Amp fuse located on the Low Voltage Connection Board.

**Air Removal** – The boiler and system plumbing layout must be configured to promote the removal of air from the water. Air vents and bleeders must be strategically placed throughout the system to aid in purging the air from the system during commissioning of the boiler. The system must also employ the use of a strategically located air removal device, such as an air scoop or hydraulic separator, designed to remove the air from the water as it flows through the system.

**NOTICE**

Follow the installation instructions included with the air removal device when placing it in the system; air removal devices generally work better when placed higher in the system. Always locate air removal devices in areas of the system that have a guaranteed positive pressure, e.g., close to the water make-up and expansion tank.

**NOTICE**

TFTN boilers are supplied with an Auto Air Vent to aid in the purging of air from the boiler during the initial fill. Place this device in the location indicated in Figure 10-1.

**Expansion Tank** – The expansion tank must be sized in accordance with the water volume of the system as well as the firing rate of the appliance. It is important to locate the expansion tank, and make-up water fill, on the inlet side of any circulator in the system, as doing so will guarantee the lowest pressure in the system will be at least equal to the tank and make-up water pressure. See examples in Figures 10-3 through 10-10.

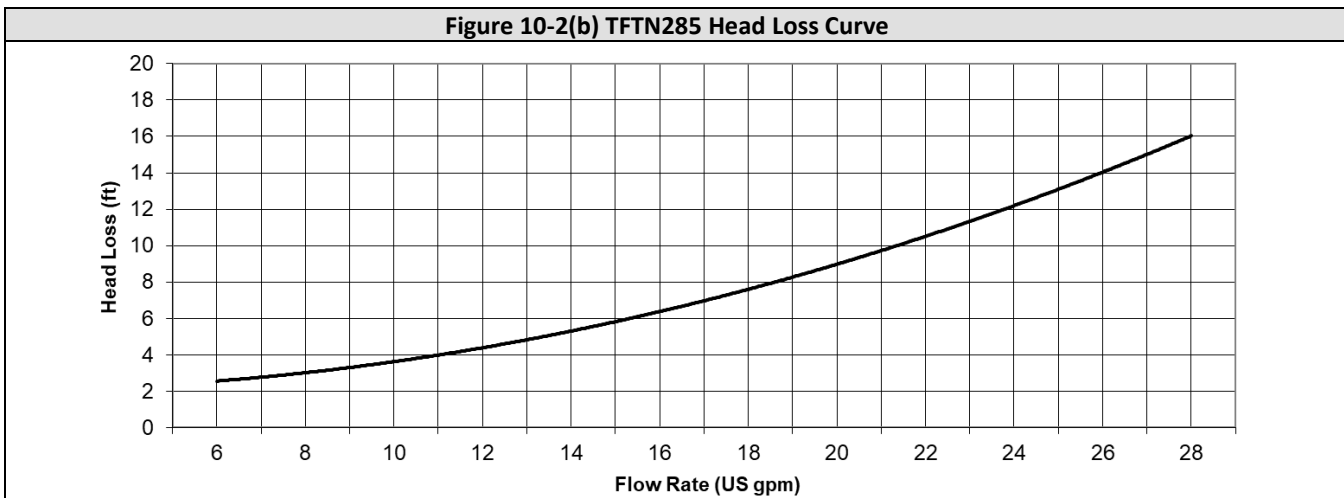
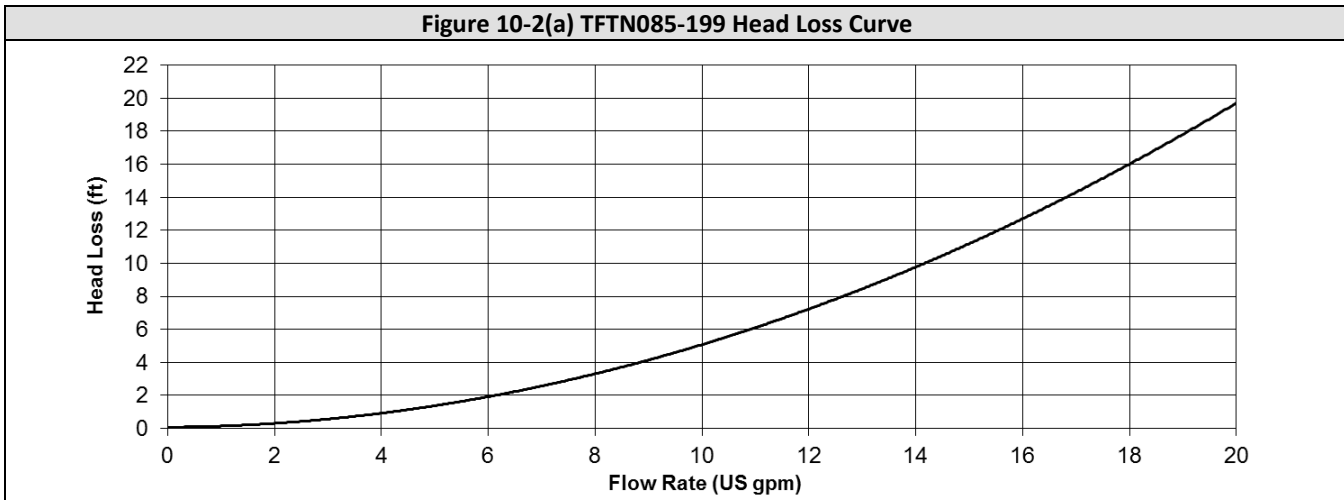
**CAUTION**

Ensure the expansion tank cannot become isolated from the boiler anytime the system is operating. Failure to follow these instructions may result in discharge of the Pressure Relief Valve may result in property damage or personal injury.

**NOTICE**

The installation of flow checks, motorized valves, or other shutoff devices (other than for the purpose of servicing) are not permitted between the location of the "Closely Spaced Tees" and the expansion tank; see Figures 10-3 through 10-10.

**Indirect Fired Water Heater** – When installed "upstream", the indirect fired water heater is in series with the boiler during a demand for DHW. Therefore, its head loss, along with the head loss of the boiler and associated piping, must be considered when sizing the circulator.



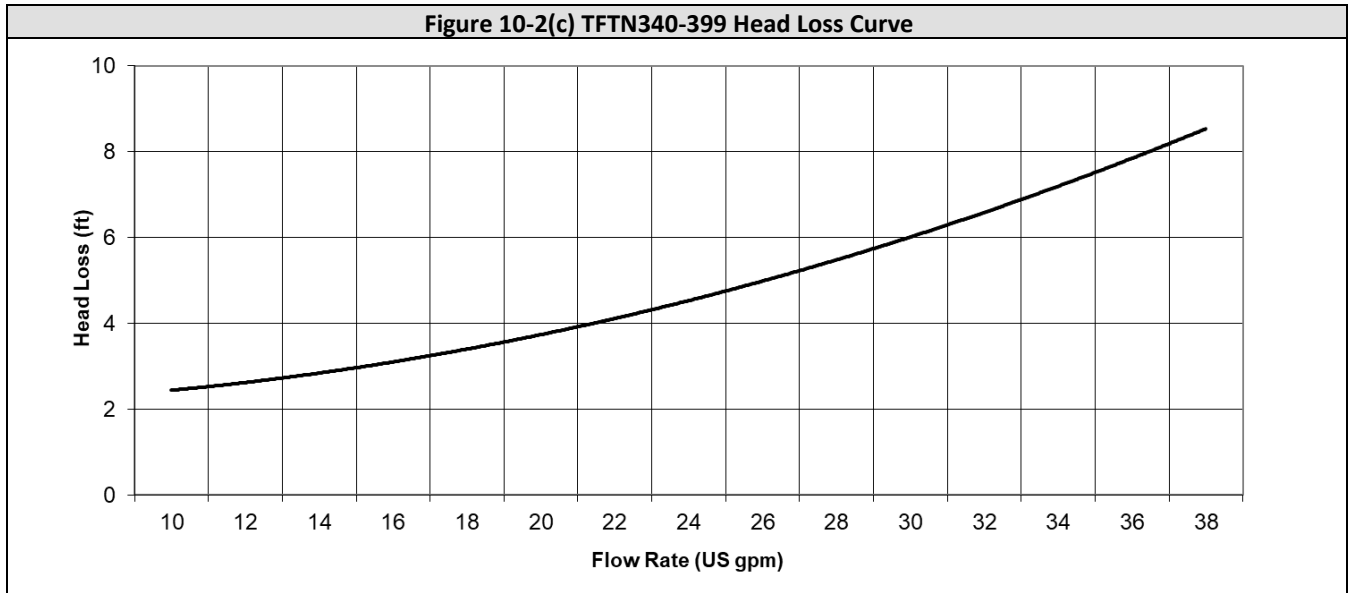


Table 10-3 Circulator and Pipe Size Requirements

Model	Temp. Rise (°F)	Boiler Flow Rate (GPM)	Boiler Head Loss (ft.)	Min. Pipe Size (in.)	Typical Primary Loop Pump Size <sup>1</sup>			
					B&G	Grundfos	Taco	Armstrong
TFTN085	20	8	3.4	1	NRF-22	UPS15-58	0015-MS	Astro 30
	25	6	2.7	1	NRF-22	UPS15-58	0015-MS	Astro 30
	35	4	1.6	¾	NRF-22	UPS15-58	0015-MS	Astro 30
TFTN110	20	10	3.9	1 <sup>2</sup>	NRF-22 <sup>2</sup>	UPS15-58	0015-MS	Astro 30 <sup>2</sup>
	25	8	3.4	1	NRF-22	UPS15-58	0015-MS	Astro 30
	35	6	2.7	1	NRF-22	UPS15-58	0015-MS	Astro 30
TFTN150	20	14	5.3	1-1/4	NRF-25	UPS26-99	0015-MS	E7
	25	11	3.9	1-1/4	NRF-22	UPS15-58	0015-MS	Astro 30
	35	8	3.1	1	NRF-22	UPS15-58	0015-MS	Astro 30
TFTN199	20	18	7.5	1-1/2	NRF-36	UPS26-99	0013-MS	E7
	25	15	5.8	1-1/4	NRF-36	UPS26-99	0013-MS	E7
	35	11	3.9	1-1/4	NRF-22	UPS15-58	0015-MS	Astro 30
TFTN285	20	26	14	1-1/2	NRF-36	UPS26-99	0013-MS	E8
	25	21	9.8	1-1/2	NRF-36	UPS26-99	0013-MS	E7
	35	15	5.7	1-1/4	NRF-25	UPS26-99	0015-MS	E7
TFTN340	20	32	7.9	2	NRF-36	UPS26-99	0012-MS	E8
	25	25	8.2	1-1/2	NRF-36	UPS26-99	0013-MS	E7
	35	18	5.7	1-1/2	NRF-36	UPS26-99	0013-MS	E7
TFTN399	20	37	8.2	2	PL55	UPS26-150	2400-60	E11
	25	29	5.7	2	NRF-36	UPS26-99	0012-MS	E8
	35	21	3.9	1-1/2	NRF-36	UPS26-99	0013-MS	E7

**Notes:**

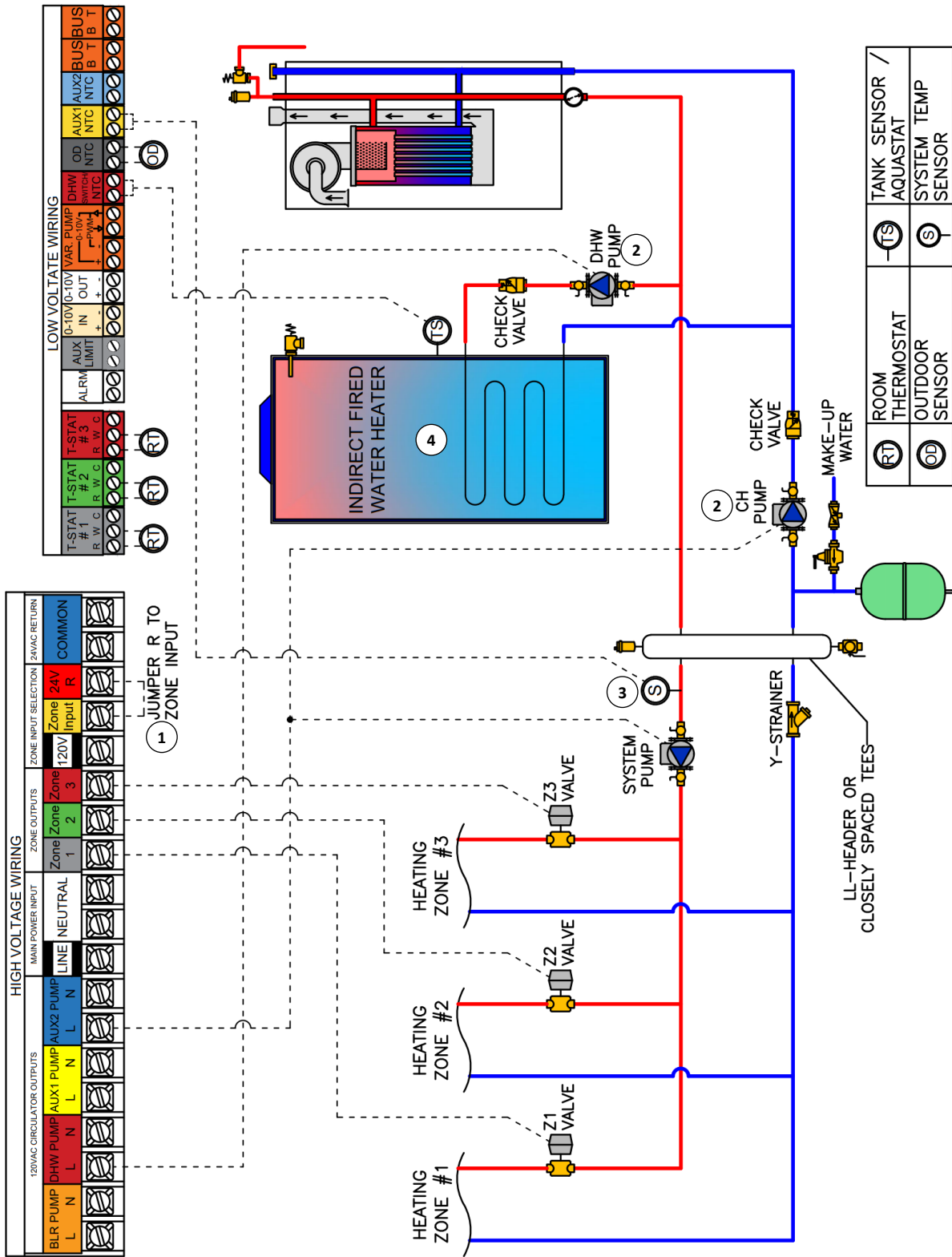
<sup>1</sup> Pump sizing based on Primary/Secondary plumbing configuration with specified minimum pipe diameter with up to 50' equivalent length.

<sup>2</sup> Upsize piping to 1-1/4 in. if using Armstrong Astro 30 or B&G NRF-22; or upsize circulator to Astro 50 or NRF-25.

**NOTICE**

Figures 10-3 through 10-10 are meant to illustrate various plumbing concepts, taking into account the boiler's control logic – they are not meant to serve as a comprehensive guide. It is the installer's responsibility to use "best practices" when designing and laying out the plumbing – including installing drain and isolation valves where required.

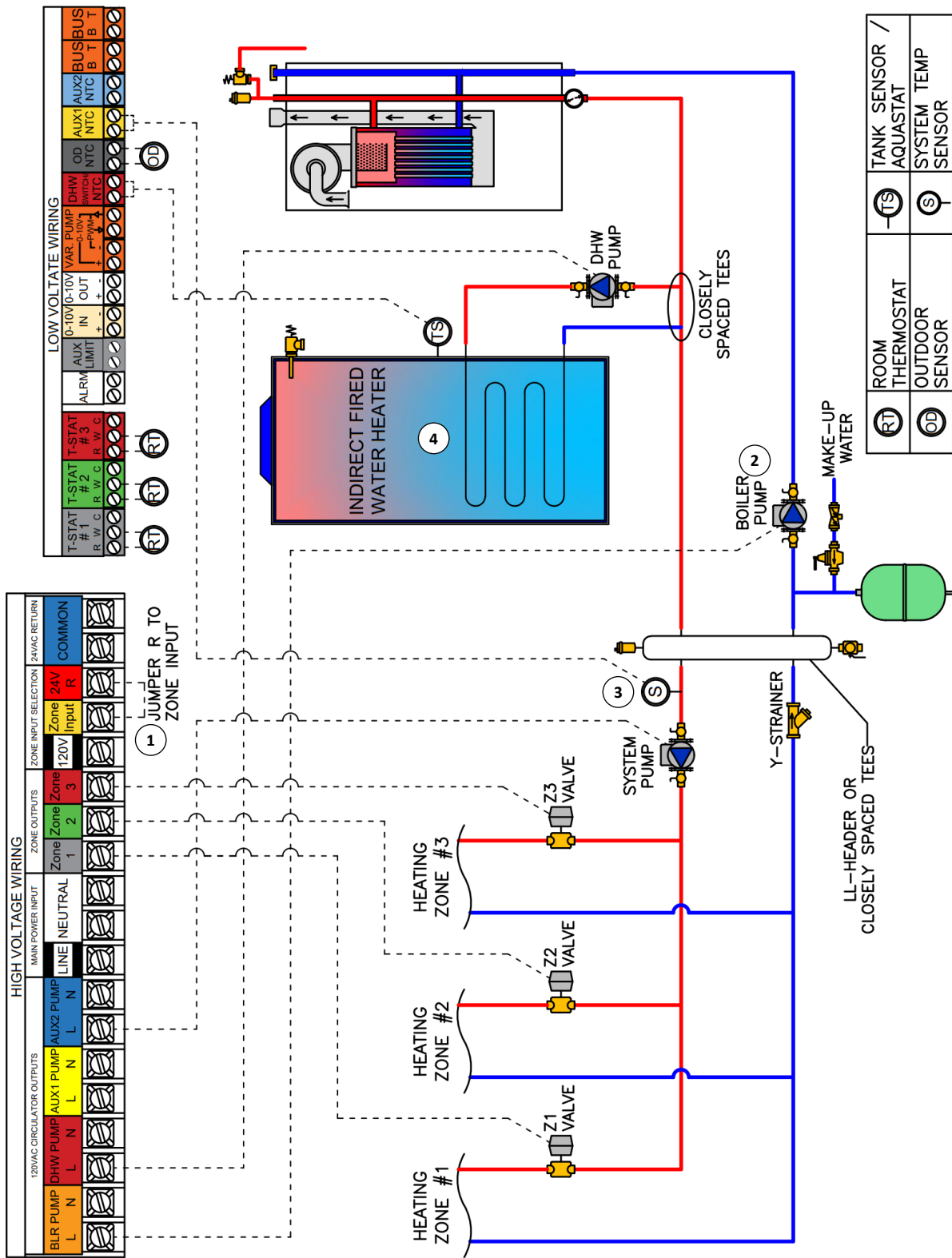
Figure 10-3 Plumbing Schematic – CH Zone Valves & Upstream IWH (Option A)



**NOTES:**

1. For ZONE 1-3 to output 24VAC (as illustrated), jumper ZONE INPUT to R (24V).
2. CH PUMP and DHW PUMP each provide the water circulation through the boiler, so size accordingly (see Table 10-3).
3. If using a System Sensor, set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = System Sensor.
4. If application uses a System Sensor, it will be necessary to set [DHW Setup](#) option [DHW Mode](#) = Upstream IWH (Tank Sensor or Aquastat); otherwise it can remain set as Downstream IWH (Tank Sensor or Aquastat).

Figure 10-4 Plumbing Schematic – CH Zone Valves & Upstream IWH (Option B)



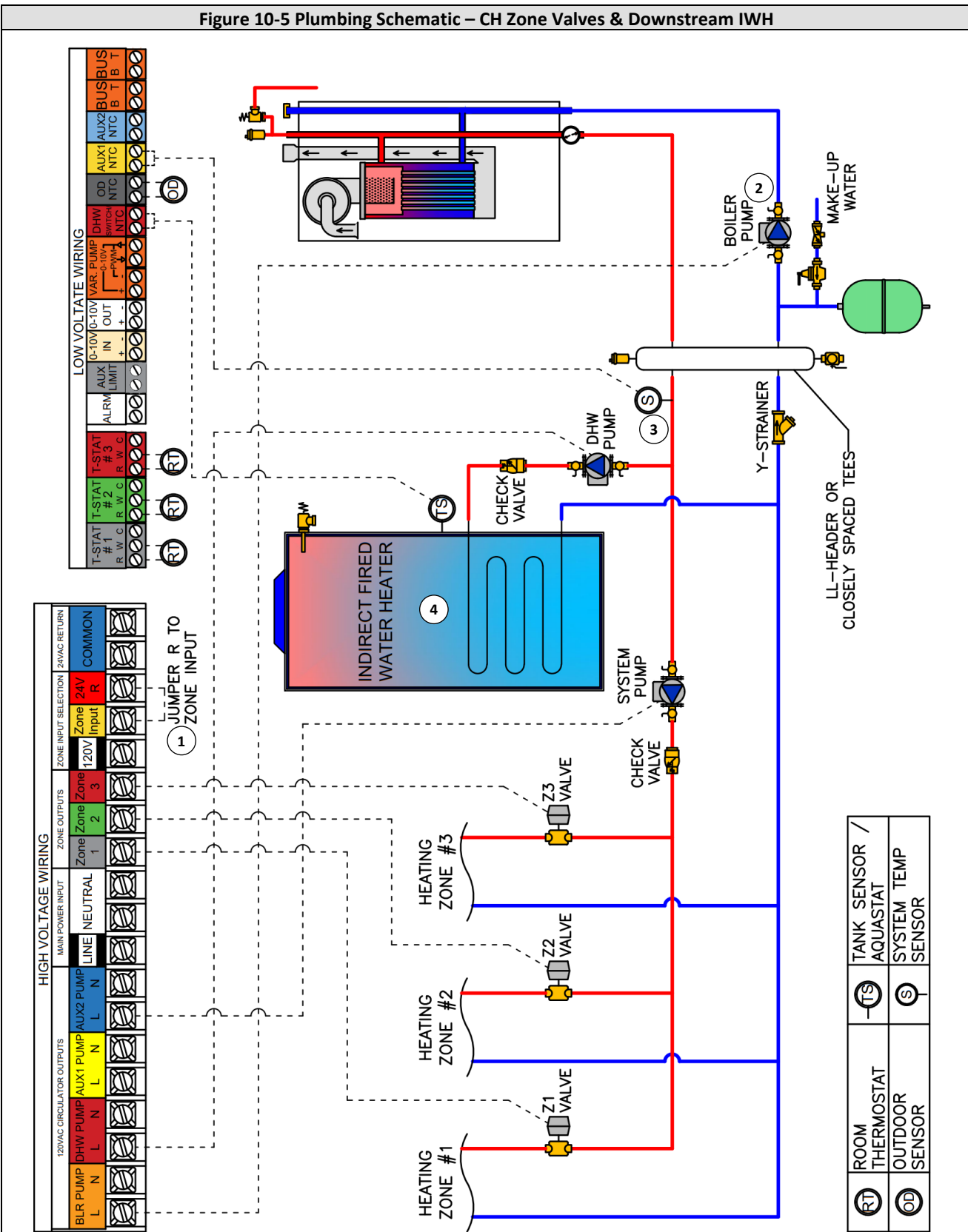
ROOM THERMOSTAT SENSOR	RT	TANK SENSOR / AQUASTAT	TS
OUTDOOR SENSOR	OD	SYSTEM TEMP SENSOR	S

**NOTES:**

1. For ZONE 1-3 to output 24VAC (as illustrated), jumper ZONE INPUT to R (24V)
2. The BOILER PUMP provides the water circulation through the boiler, so size accordingly (see Table 10-3).
3. If using a System Sensor, set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = System Sensor.
4. If application uses a System Sensor, it will be necessary to set [DHW Setup](#) option [DHW Mode](#) = Upstream IWH (Tank Sensor or Aquastat); otherwise it can remain set as Downstream IWH (Tank Sensor or Aquastat).



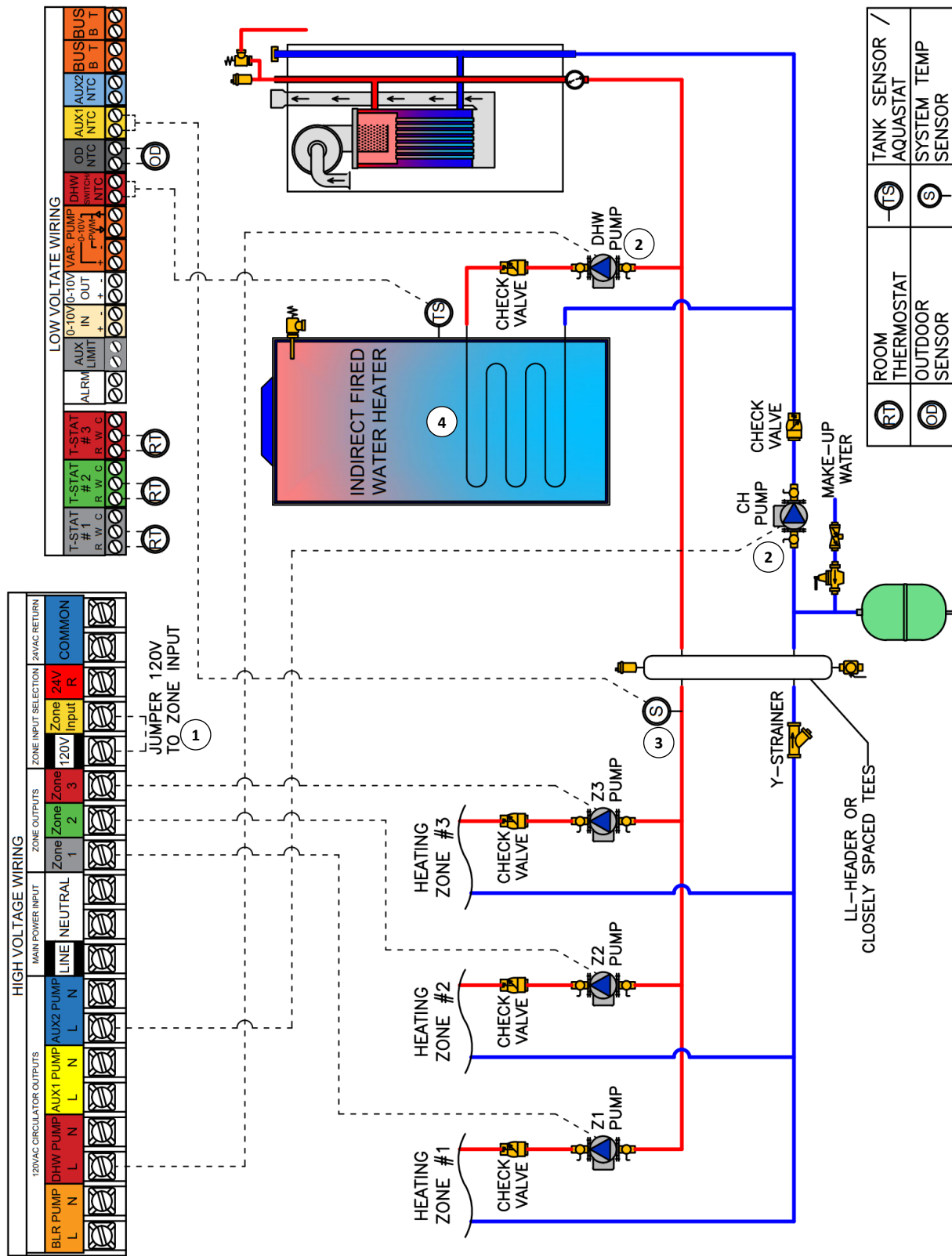
Figure 10-5 Plumbing Schematic – CH Zone Valves & Downstream IWH



**NOTES:**

- For ZONE 1-3 to output 24VAC (as illustrated), jumper ZONE INPUT to R (24V)
- The BOILER PUMP provides the water circulation through the boiler, so size accordingly (see Table 10-3).
- If using a System Sensor, set [Sensor Configuration](#) option **Auxiliary Sensor 1** (24.6.1) = System Sensor.
- If application uses a System Sensor, it will be necessary to set [DHW Setup](#) option **DHW Mode** = Downstream IWH (Tank Sensor or Aquastat); otherwise it is acceptable to be set as Upstream IWH (Tank Sensor or Aquastat).

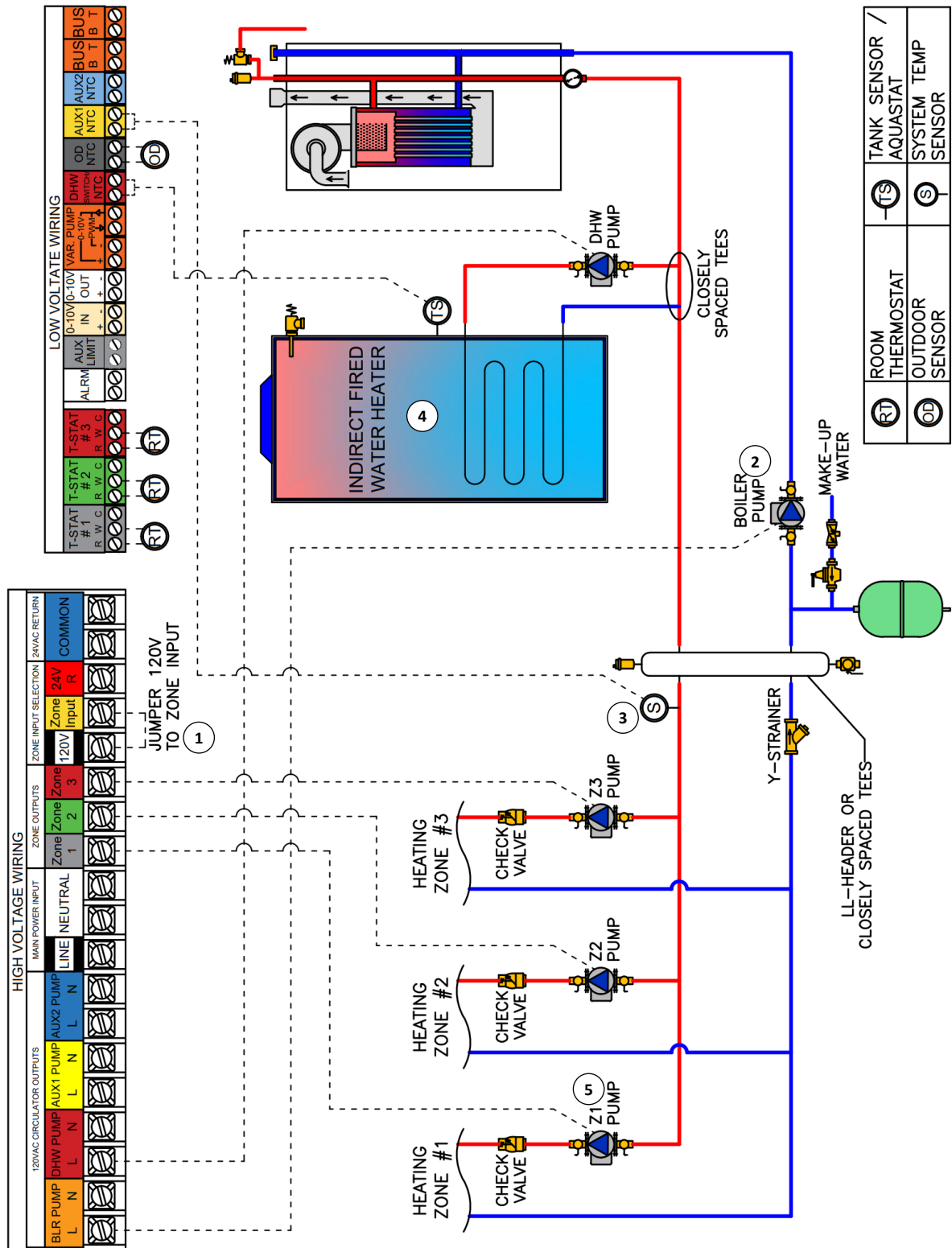
Figure 10-6 Plumbing Schematic – CH Zone Pumps & Upstream IWH (Option A)



**NOTES:**

1. For ZONE 1-3 to output 120VAC (as illustrated), jumper ZONE INPUT to 120V
2. CH PUMP and DHW PUMP each provide the water circulation through the boiler, so size accordingly (see Table 10-3).
3. If using a System Sensor, set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = System Sensor.
4. If the application uses a System Sensor, set [DHW Setup](#) option [DHW Mode](#) = Upstream IWH (Tank Sensor or Aquastat); otherwise it can be set as Downstream IWH (Tank Sensor or Aquastat).

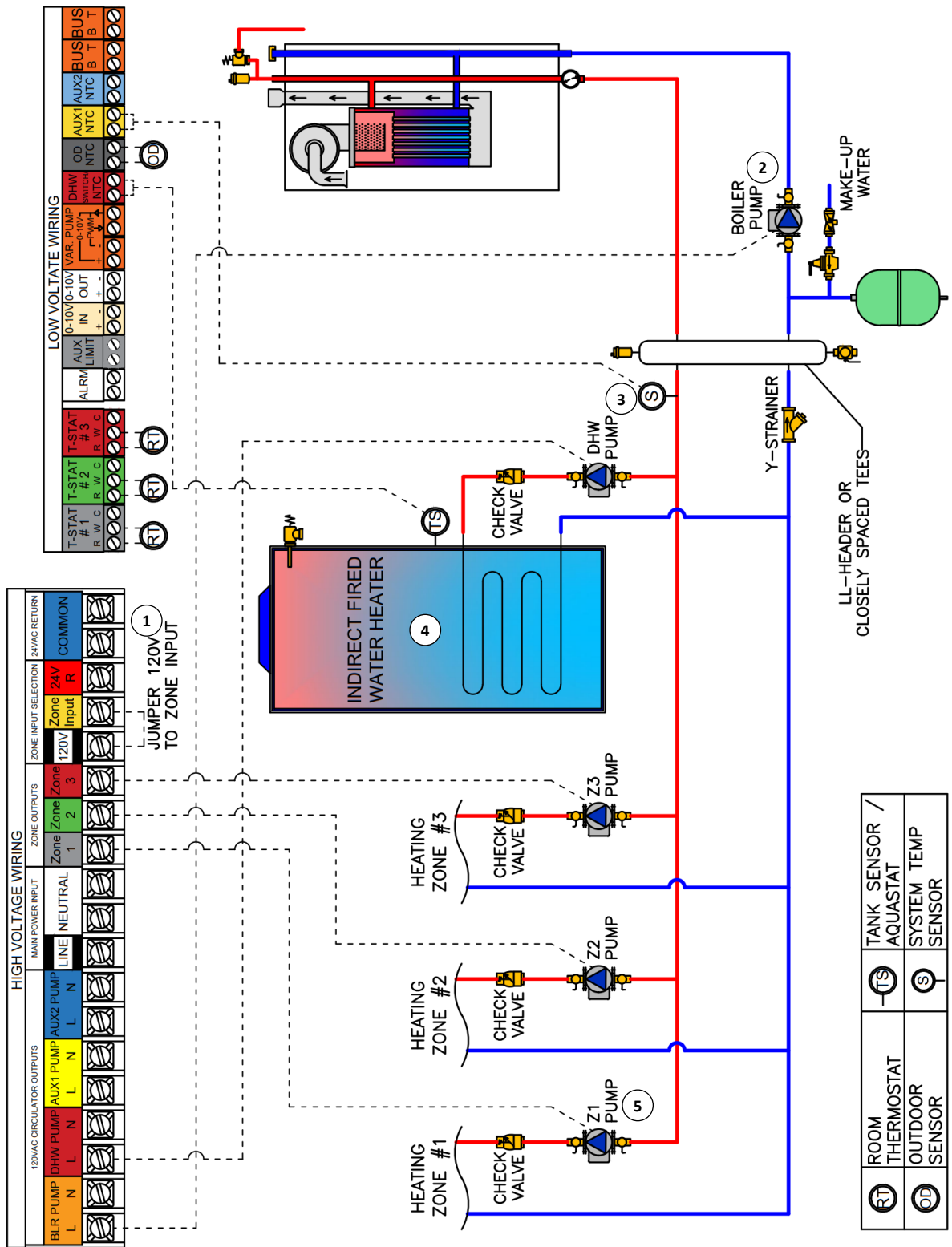
Figure 10-7 Plumbing Schematic – CH Zone Pumps & Upstream IWH (Option B)



**NOTES:**

- For ZONE 1-3 to output 120VAC (as illustrated), jumper ZONE INPUT to 120V
- The BOILER PUMP provides the water circulation through the boiler, so size accordingly (see Table 10-3).
- If using a System Sensor, set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = System Sensor.
- If the application uses a System Sensor, set [DHW Setup](#) option [DHW Mode](#) = Upstream IWH (Tank Sensor or Aquastat); otherwise it can be set as Downstream IWH (Tank Sensor or Aquastat).
- To prevent zone pumps from post-circulating during DHW demands, set [Pump Control Settings](#) option [Zone Outputs Overrun During DHW](#) (7.2.9) = Off.

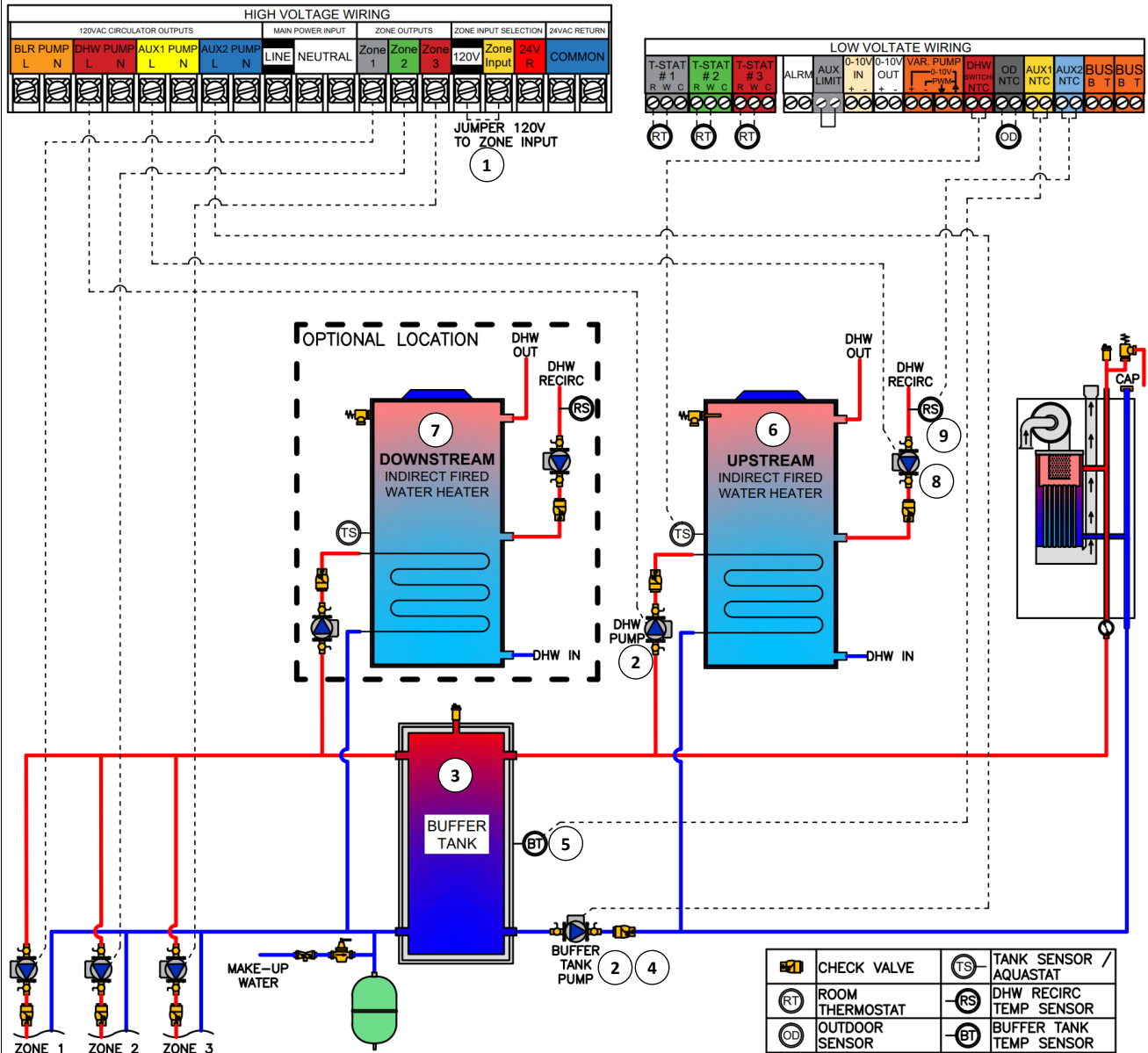
Figure 10-8 Plumbing Schematic – CH Zone Pumps & Downstream IWH



**NOTES:**

1. For ZONE 1-3 to output 120VAC (as illustrated), jumper ZONE INPUT to 120V
2. The BOILER PUMP provides the water circulation through the boiler, so size accordingly (see Table 10-3).
3. If using a System Sensor, set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = System Sensor.
4. If the application uses a System Sensor, set [DHW Setup](#) option [DHW Mode](#) = Downstream IWH (Tank Sensor or Aquastat); otherwise it can be set as Upstream IWH (Tank Sensor or Aquastat).
5. To prevent zone pumps from post-circulating during DHW demands, set [Pump Control Settings](#) option [Zone Outputs Overrun During DHW](#) (7.2.9) = Off.

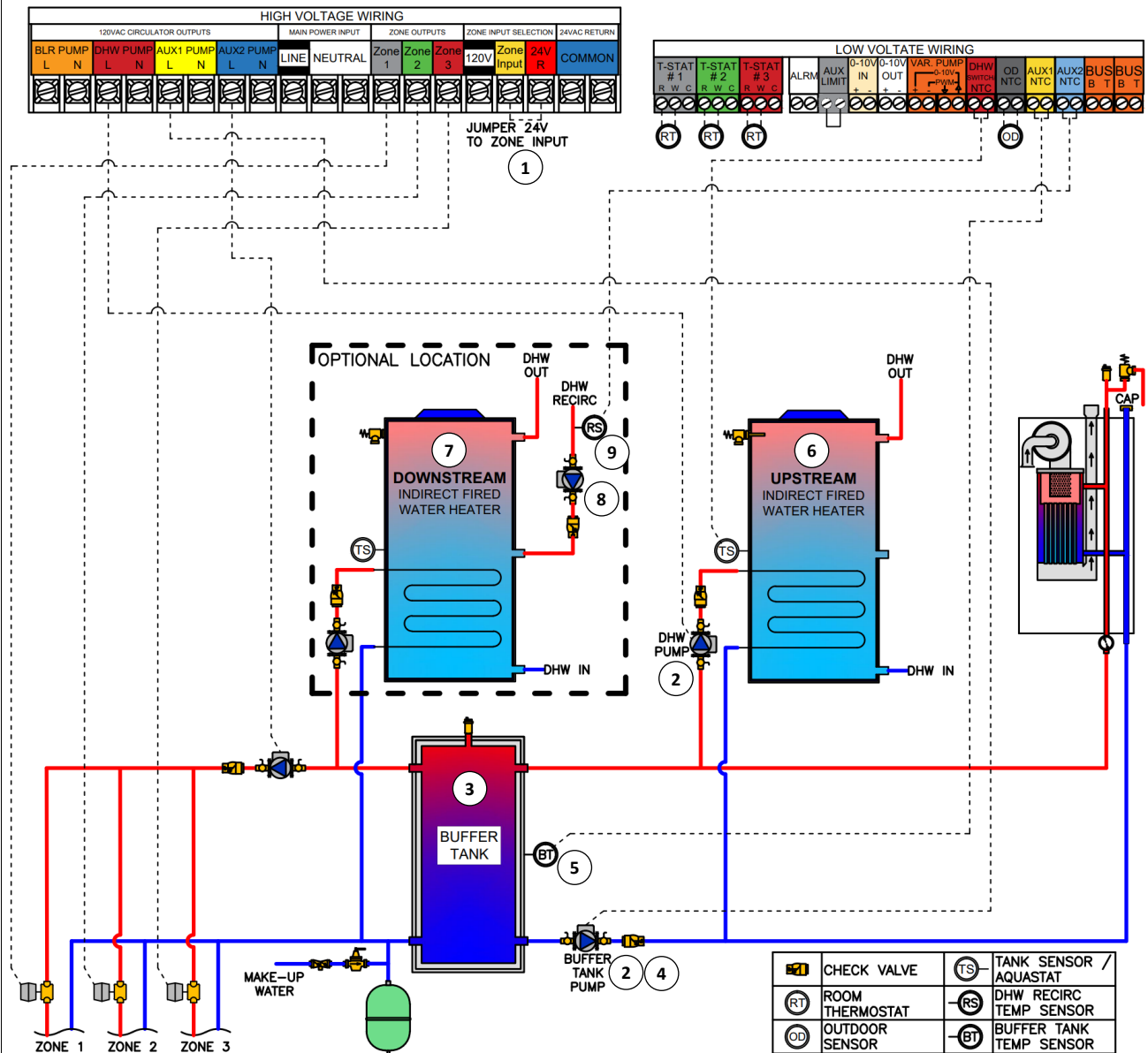
Figure 10-9 Plumbing Schematic – CH Zone Pumps, Buffer Tank & DHW Recirc



NOTES:

- For ZONE 1-3 to output 120VAC (as illustrated), jumper ZONE INPUT to 120V.
- The DHW and BUFFER TANK PUMPS each provide the water circulation through the boiler, so size accordingly (see Table 10-3).
- Via the [CH Setup](#) menu, with Zone Selection = Buffer Tank, set [Buffer Tank Function](#) (20.0.0/7) = Fixed or Variable Temperature. **NOTICE:** the boiler services the buffer tank and Upstream IWH; CH zones and Downstream IWH are serviced by the buffer tank.
- BUFFER TANK PUMP – connect to [AUX2 PUMP](#) and set [Pump Control Settings](#) option [Auxiliary Pump 2 Selection](#) (24.7.1) = Buffer Tank.
- Buffer Tank Sensor – mandatory when using Buffer Tank Function. Connect to [AUX1 NTC](#) and set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = Buffer Tank.
- Upstream IWH – set [DHW Setup](#) option [DHW Mode](#) = Upstream IWH (Tank Sensor or Aquastat).
- Downstream IWH – set [DHW Setup](#) option [DHW Mode](#) = Downstream IWH (Tank Sensor or Aquastat).
- DHW RECIRC PUMP – connect to [AUX1 PUMP](#) and set [Pump Control Settings](#) option [Auxiliary Pump 1 Selection](#) (24.7.0) = DHW Recirc.
- DHW Recirc Sensor – connect to [AUX2 NTC](#) and set [Sensor Configuration](#) option [Auxiliary Sensor 2](#) (24.6.2) = DHW Recirc.
- To prevent zone pumps from post-circulating during DHW demands, set [Pump Control Settings](#) option [Zone Outputs Overrun During DHW](#) (7.2.9) = Off.
- CAUTION:** when combining low and high temperature zones with the use of a buffer tank, it may be necessary to install a mixing device to protect the low temperature zones from overheating.

Figure 10-10 Plumbing Schematic – CH Zone Valves, Buffer Tank & DHW Recirc



**NOTES:**

- For ZONE 1-3 to output 24VAC (as illustrated), jumper ZONE INPUT to R (24V).
- The DHW and BUFFER TANK PUMPS each provide the water circulation through the boiler, so size accordingly (see Table 10-3).
- Via the [CH Setup](#) menu, with Zone Selection = Buffer Tank, set [Buffer Tank Function](#) (20.0.0/7) = Fixed or Variable Temperature. **NOTICE:** the boiler services the buffer tank and Upstream IWH; CH zones and Downstream IWH are serviced by the buffer tank.
- BUFFER TANK PUMP – connect to [AUX1 PUMP](#) and set [Pump Control Settings](#) option [Auxiliary Pump 1 Selection](#) (24.7.0) = Buffer Tank. **NOTICE:** to retain the use of the [AUX1 PUMP](#) output for DHW Recirc, connect the BUFFER TANK PUMP to [BLR PUMP](#) (only applicable if heating a Downstream IWH).
- Buffer Tank Sensor – mandatory when using Buffer Tank Function. Connect to [AUX1 NTC](#) and set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = Buffer Tank.
- Upstream IWH – set [DHW Setup](#) option [DHW Mode](#) = Upstream IWH (Tank Sensor or Aquastat). **NOTICE:** DHW Recirc is not possible from an Upstream IWH in an application using a Buffer Tank and System Pump.
- Downstream IWH – set [DHW Setup](#) option [DHW Mode](#) = Downstream IWH (Tank Sensor or Aquastat).
- DHW RECIRC PUMP – connect to [AUX1 PUMP](#) and set [Pump Control Settings](#) option [Auxiliary Pump 1 Selection](#) (24.7.0) = DHW Recirc.
- DHW Recirc Sensor – connect to [AUX2 NTC](#) and set [Sensor Configuration](#) option [Auxiliary Sensor 2](#) (24.6.2) = DHW Recirc.
- CAUTION:** when combining low and high temperature zones with the use of a buffer tank, it may be necessary to install a mixing device to protect the low temperature zones from overheating.

## 11.0 CASCADE INSTALLATION

### Multiple Boiler Applications

The TFTN controller has the internal capacity to stage/lead-lag up to eight (8) TFTN boilers connected in cascade, without the need for external controls. Each boiler in cascade is connected to the BUS circuit, which allows the “Manager” boiler to communicate with and control the “Follower Boilers”. Use the instructions detailed in the section to complete the installation and setup of the cascade, taking care to follow the instructions in the order presented.

### 11.1 General Installation Instructions

Before performing the Setup Procedure, and before turning the power on or connecting the BUS terminals to each boiler, proceed with the following General Installation Instructions:

1. **Plumbing** – install as many as 8 TFTN boilers in parallel in a primary/secondary plumbing configuration as illustrated in Figure 11-1. Size common piping as per Table 11-1.
2. **Boiler Pump** – each boiler must have its own circulator which is controlled by its respective *BLR PUMP* output (or *AUX1/2 PUMP* output in the case the boiler is connected to an Upstream IWH); see Figure 11-1. The Boiler Pump must be sized according to Table 10-3.
3. **System Pump** (if applicable) – wire to the *AUX2 PUMP* output of the boiler set as Manager; see Figure 11-1.
4. **DHW Pump – Downstream IWH** (if applicable) – wire to the *DHW PUMP* output of the boiler that will be set as Manager; see Figure 11-1.
5. **DHW Pump – Upstream IWH** (if applicable) – wire to the *DHW PUMP* output of the boiler that the Upstream IWH is piped to; see Figure 11-1.

**NOTE:** The Manager boiler cannot be configured to heat an Upstream IWH if the cascade system includes a Downstream IWH. When a Downstream IWH is present, Upstream IWHs may only be connected to the Follower Boilers.

6. **System Sensor** (mandatory) – install a system sensor (NTI P/N: 84010) on the common outlet (supply) pipe feeding the heating system and wire it to the *AUX1 NTC* input of the boiler that will be set as Manager; see Figure 11-1.

**NOTE:** A system sensor is needed for the cascade system to function properly. Failure to connect the system sensor and properly configure the *AUX1 NTC* input will result in “Blocking Error 115” (Common flow sensor error), and the cascade will function using an average of the outlet temperature from each boiler in cascade.

7. **Outdoor Sensor** (optional) – wire the outdoor sensor to the *OD NTC* input of the boiler that will be set as Manager; see Figure 11-1.
8. **Downstream IWH DHW Tank Sensor or Aquastat** (if applicable) – wire to the *DHW SWITCH/NTC* input of the boiler that will be set as Manager; see Figure 11-1.
9. **Upstream IWH DHW Tank Sensor or Aquastat** (if applicable) – wire to the *DHW SWITCH/NTC* input of the boiler that the Upstream IWH is piped to; see Figure 11-1

**NOTE:** The Manager boiler cannot be configured to heat an Upstream IWH if the cascade system includes a Downstream IWH. When a Downstream IWH is present, Upstream IWHs may only be connected to the Follower Boilers.

10. **DHW Recirc Sensor** (if applicable) – connect to the *AUX2 NTC* input of the boiler that will be set as Manager.
11. **Buffer Tank Sensor** (if applicable) – connect to the *AUX2 NTC* input of the boiler that will be set as Manager.

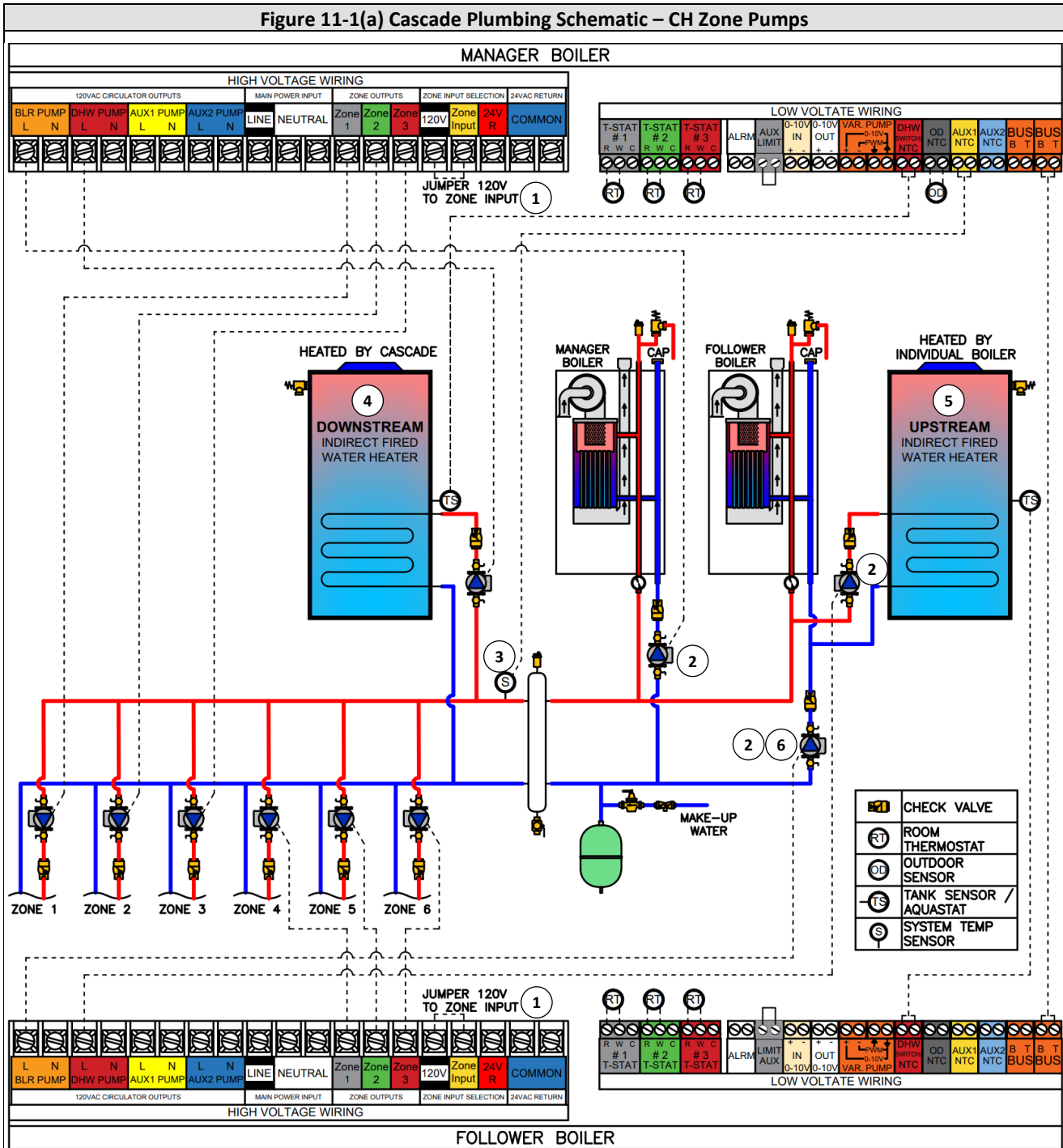
**NOTE:** The *AUX2 NTC* input can be used to connect either a DHW Recirc sensor or a Buffer Tank sensor, not both. Cascade configurations are not compatible with applications requiring both DHW recirculation temperature control and buffer tank temperature control.

12. **CH Thermostat Inputs and Zone Outputs** – connect up-to six (6) thermostat inputs to T-STAT #1/2/3 at two (2) of the TFTN boilers in cascade. Connect the respective zone loads (pumps or valves) to the same boiler’s ZONE OUTPUTS (ZONE 1/ZONE 2/ZONE 3).

**NOTE:** Each TFTN boiler is equipped with a zone controller capable of operating 3 zones, but only two of the zone controllers can remain connected on the BUS when cascading (for a total of 6 zones), the others need to be disconnected; see Figure 11-2.

**NOTE:** Zones 1, 2 and 3 at the boiler whose zone controller have the dipswitches set to off, become zones 4, 5 and 6 respectively; see Figure 11-2. The examples in Figure 11-1 assume that the Follower boiler’s zone control dipswitches are set to off, while the Manager boiler’s dip switches remained in the factory on position.

Figure 11-1(a) Cascade Plumbing Schematic – CH Zone Pumps

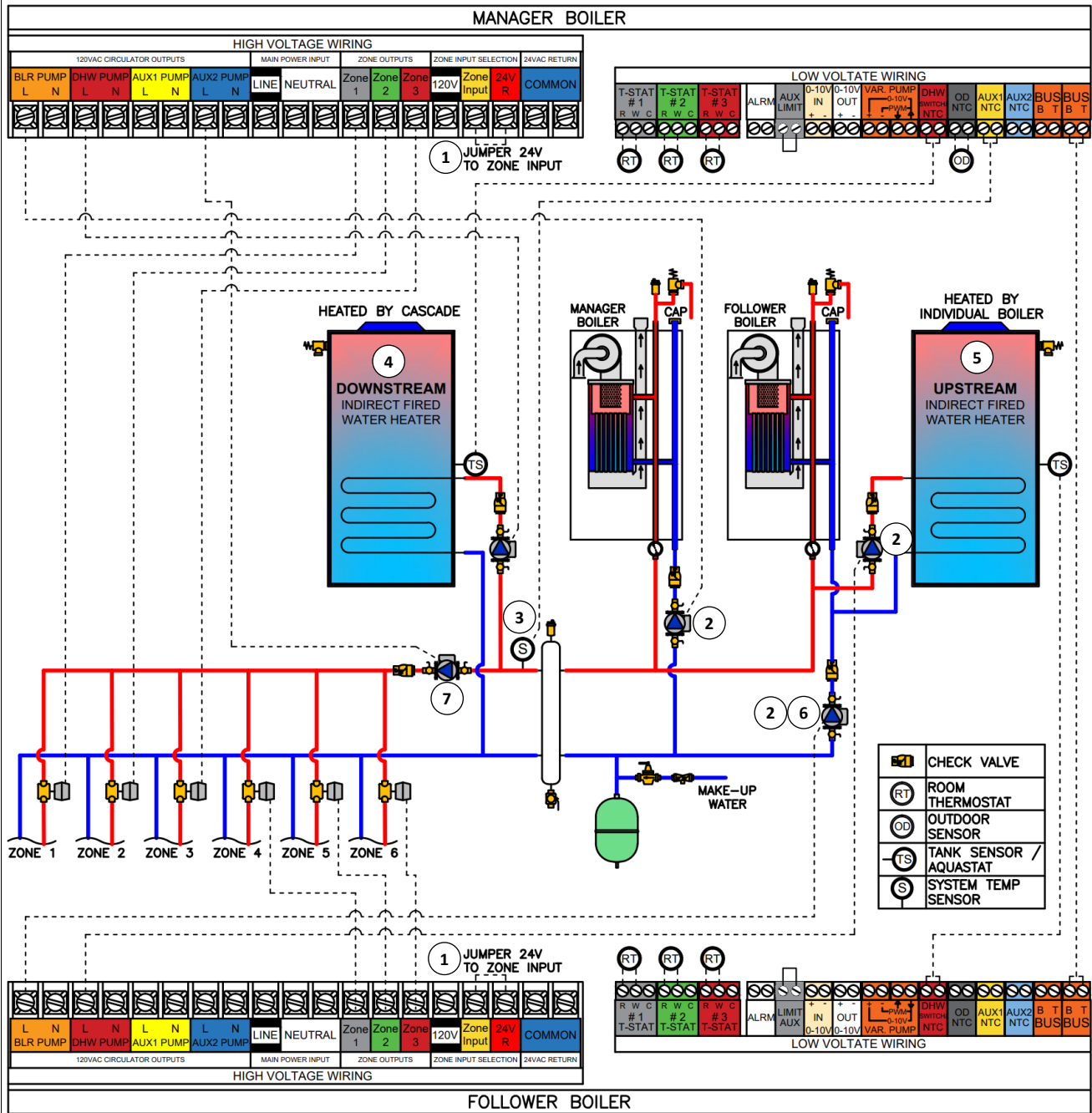


**NOTES:**

1. For ZONE 1, ZONE 2 & ZONE 3 to output 120VAC (as illustrated), jumper ZONE INPUT to 120V.
2. Pumps responsible for circulating water through the boiler must be sized accordingly (see Tables 10-2 & 10-3).
3. System Sensor – mandatory in cascade configurations; must be installed downstream of the LL-header. Connect to AUX1 NTC at Manager boiler and set [Sensor Configuration](#) option Auxiliary Sensor 1 (24.6.1) = System Sensor.
4. Downstream IWH – connect the Tank Sensor (or Aquastat) and DHW Pump to the Manager boiler and set [Cascade Setup](#) option DHW Mode (Cascade) = Downstream IWH (Tank Sensor or Aquastat).
5. Upstream IWH – connect the Tank Sensor (or Aquastat) and DHW Pump to the boiler it is piped to and set the respective boiler's [DHW Setup](#) option DHW Mode = Upstream IWH (Tank Sensor or Aquastat).  
**NOTE:** an Upstream IWH cannot be connected (piped/wired) to a Manager boiler if there is a Downstream IWH.
6. For boilers connected to an Upstream IWH, connect the “boiler pump” at AUX1 PUMP or AUX2 PUMP and set [Pump Control Settings](#) option Auxiliary Pump 1 Selection (x.7.0) or Auxiliary Pump 2 Selection (x.7.1) = Cascade Pump.  
**NOTE:** to access the Cascade Pump setting option it may be necessary to configure x.7.0/x.7.1 from the [Complete Menu](#) (x = 24 for Manager; 26 for Follower 1; 27 for Follower 2; etc.).



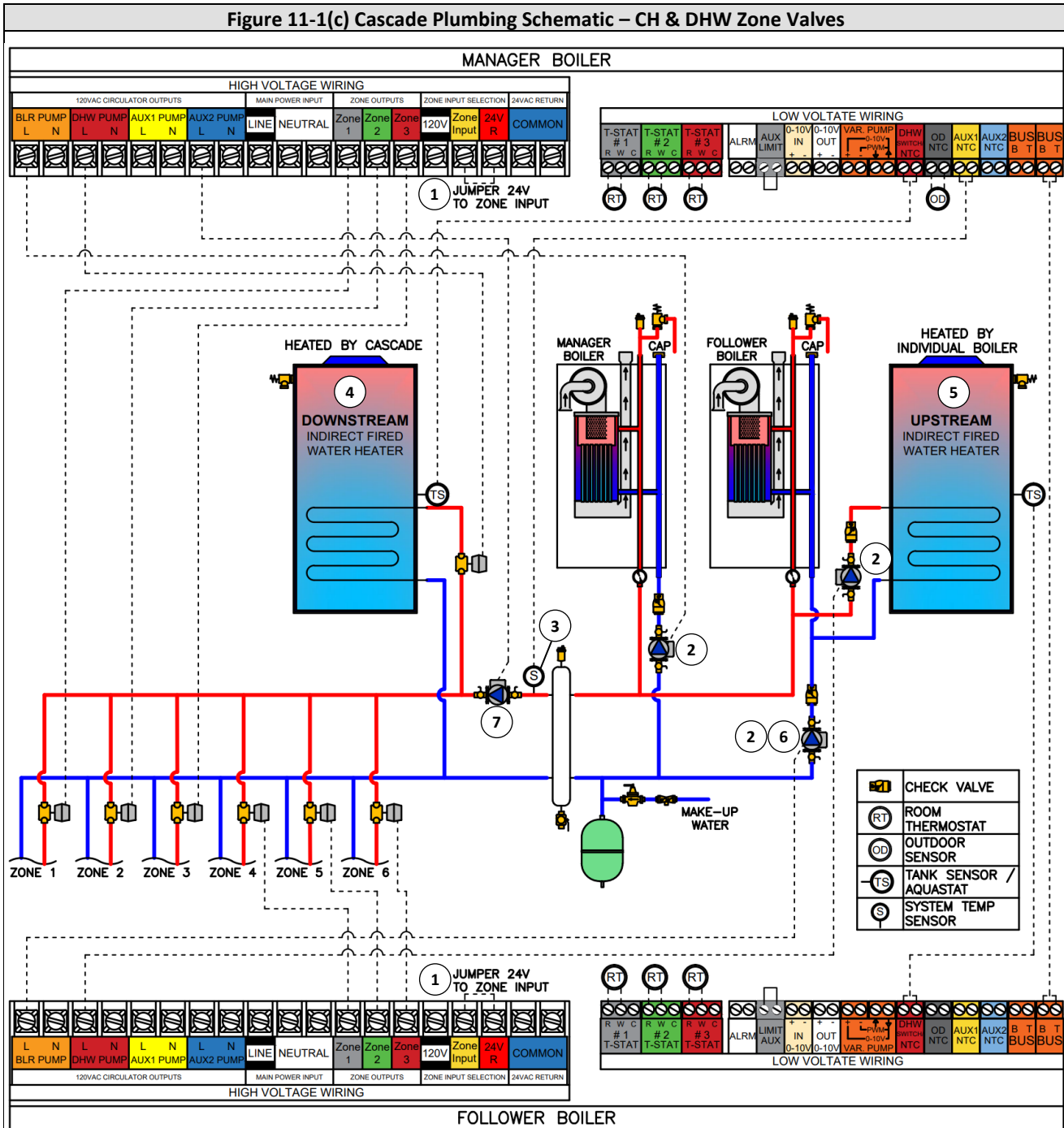
Figure 11-1(b) Cascade Plumbing Schematic – CH Zone Valves (DHW Pump)



**NOTES:**

1. For ZONE 1, ZONE 2 & ZONE 3 to output 24VAC (as illustrated), jumper ZONE INPUT to R (24V).
2. Pumps responsible for circulating water through the boiler must be sized accordingly (see Tables 10-2 & 10-3).
3. System Sensor – mandatory in cascade configurations; must be installed downstream of the LL-header. Connect to AUX1 NTC at Manager boiler and set [Sensor Configuration](#) option Auxiliary Sensor 1 (24.6.1) = System Sensor.
4. Downstream IWH – connect the Tank Sensor (or Aquastat) and DHW Pump to the Manager boiler and set [Cascade Setup](#) option DHW Mode (Cascade) = Downstream IWH (Tank Sensor or Aquastat).
5. Upstream IWH – connect the Tank Sensor (or Aquastat) and DHW Pump to the boiler it is piped to and set the respective boiler's [DHW Setup](#) option DHW Mode = Upstream IWH (Tank Sensor or Aquastat).  
**NOTE:** an Upstream IWH cannot be connected (piped/wired) to a Manager boiler if there is a Downstream IWH.
6. For boilers connected to an Upstream IWH, connect the “boiler pump” at AUX1 PUMP and set [Pump Control Settings](#) option Auxiliary Pump 1 Selection (x.7.0) = Cascade Pump. **NOTE:** it may be necessary to configure x.7.0 from the [Complete Menu](#) (x = 24 for Manager; 26 for Follower 1; 27 for Follower 2; etc.).
7. System Pump – connect to the AUX2 PUMP output at the Manager boiler.

Figure 11-1(c) Cascade Plumbing Schematic – CH & DHW Zone Valves



**NOTES:**

1. For ZONE 1, ZONE 2 & ZONE 3 to output 24VAC (as illustrated), jumper ZONE INPUT to R (24V).
2. Pumps responsible for circulating water through the boiler must be sized accordingly (see Tables 10-2 & 10-3).
3. System Sensor – mandatory in cascade configurations; must be installed downstream of the LL-header. Connect to AUX1 NTC at the Manager boiler and set [Sensor Configuration](#) option [Auxiliary Sensor 1](#) (24.6.1) = System Sensor.
4. Downstream IWH – connect the Tank Sensor (or Aquastat) and DHW Zone Valve to the Manager boiler and set [Cascade Setup](#) option [DHW Mode \(Cascade\)](#) = Downstream IWH (Tank Sensor or Aquastat).  
**NOTE:** the boiler outputs 120VAC at the DHW PUMP connection, isolate with a relay if using a 24V DHW Zone Valve.
5. Upstream IWH – connect the Tank Sensor (or Aquastat) and DHW Pump to the boiler it is piped to and set the respective boiler's [DHW Setup](#) option [DHW Mode](#) = Upstream IWH (Tank Sensor or Aquastat).  
**NOTE:** an Upstream IWH cannot be connected (piped/wired) to a Manager boiler if there is a Downstream IWH.
6. For boilers connected to an Upstream IWH, connect the “boiler pump” at AUX1 PUMP and set [Pump Control Settings](#) option [Auxiliary Pump 1 Selection](#) (x.7.0) = Cascade Pump. **NOTE:** it may be necessary to configure x.7.0 from the [Complete Menu](#) (x = 24 for Manager; 26 for Follower 1; 27 for Follower 2; etc.).
7. System Pump – connect to the AUX2 PUMP output at the Manager boiler.

Table 11-1 Minimum Pipe Sizes for Multiple Boiler Applications

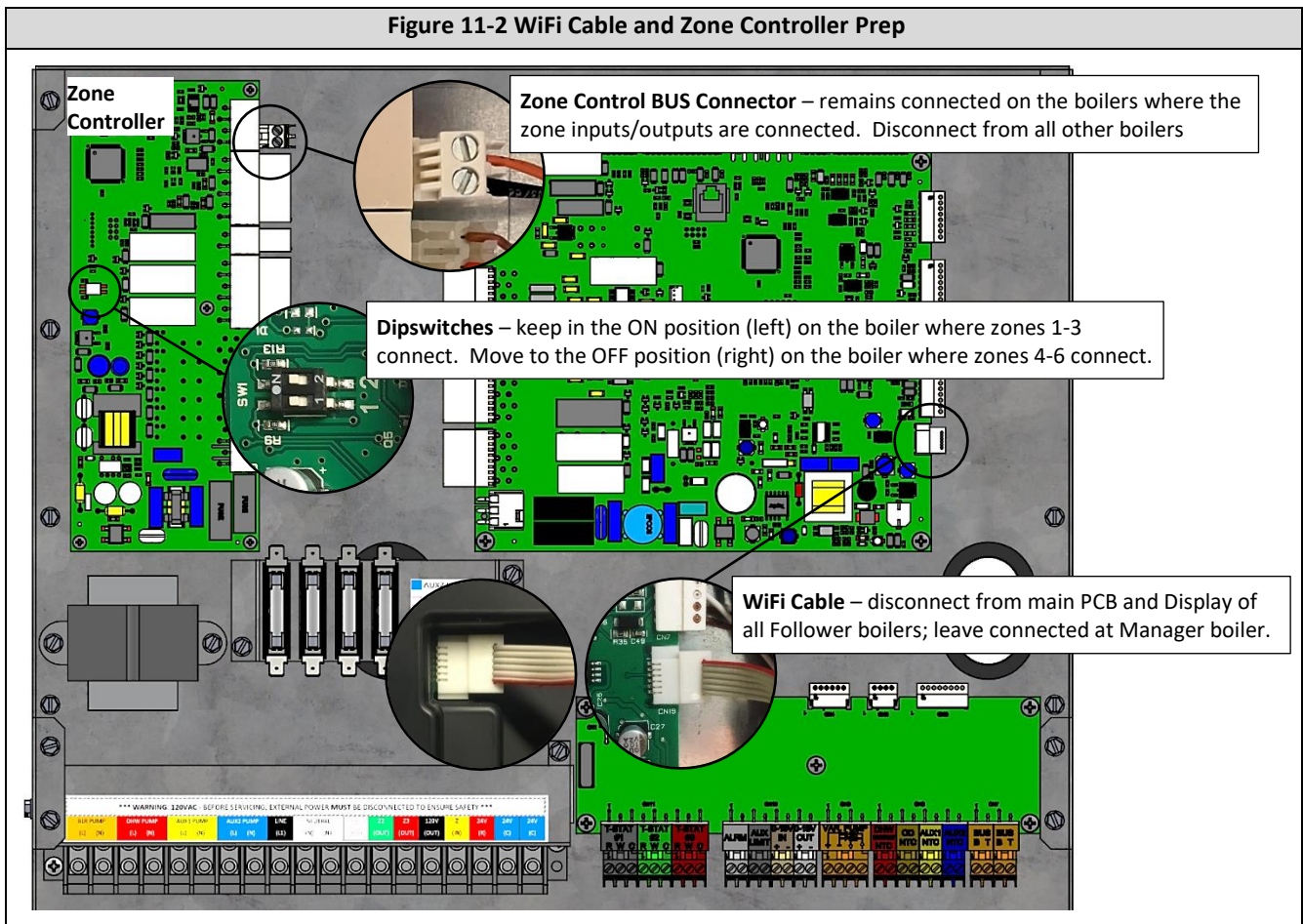
# of Units	TFTN085	TFTN110	TFTN150	TFTN199	TFTN285	TFTN340	TFTN399
2	1-1/4 in.	1-1/4 in.	1-1/2 in.	2 in.	2 in.	2 in.	2-1/2 in.
3	1-1/4 in.	1-1/2 in.	2 in.	2 in.	2-1/2 in.	2-1/2 in.	3 in.
4	1-1/2 in.	2 in.	2 in.	2-1/2 in.	3 in.	3 in.	4 in.
5	2 in.	2 in.	2 in.	2-1/2 in.	3 in.	4 in.	4 in.
6	2 in.	2 in.	2-1/2 in.	3 in.	4 in.	4 in.	4 in.
7	2 in.	2-1/2 in.	2-1/2 in.	3 in.	4 in.	4 in.	5 in.
8	2 in.	2-1/2 in.	3 in.	4 in.	4 in.	5 in.	5 in.

**NOTE:** minimum pipe sizes are based on the flow necessary to achieve a 25°F delta-T at Max Power.

### 11.2 Setup Procedure

After completing the General Installation above, and before turning the power on or connecting the BUS terminals to each boiler, proceed with the following Setup Procedure in the order listed:

1. **Disconnect WiFi Cable from Follower Boilers** – Permanently disconnect and remove the WiFi Cable from each Follower boiler; only the Manager boiler can be connected to WiFi – see Figure 11-2. Connecting more than one WiFi module (integrated inside the display) will result in a BUS network communication error.
2. **Configure Zone Controllers** – the zone controller of the boiler where zones 1-3 connect (typically the Manager boiler) remains in the factory configuration, i.e., BUS wire connected and dipswitches in the ON position. The BUS wire also remains connected to the zone controller of the boiler where zones 4-6 connect, but the dipswitches must be moved to the OFF position. The BUS wire must be disconnected from the zone controller of all other boilers connected to the cascade. See Figure 11-2



3. **Set Boiler Address** – turn the power on to each boiler and set the Boiler Address from the [Cascade Setup](#) menu. The boiler chosen for connecting the System Sensor (and if applicable Outdoor, DHW Recirc or Buffer Tank Sensors and System Pump) must be set as Manager, while the others must be set uniquely as Follower Boiler 1, 2...7. See Figure 11-3.

Figure 11-3 Setting Boiler Address

**1** Select **Setup** from the home screen

**2** Select **Tech Menu** from the Setup menu

**3** Select **Cascade Setup** from the Tech Menu

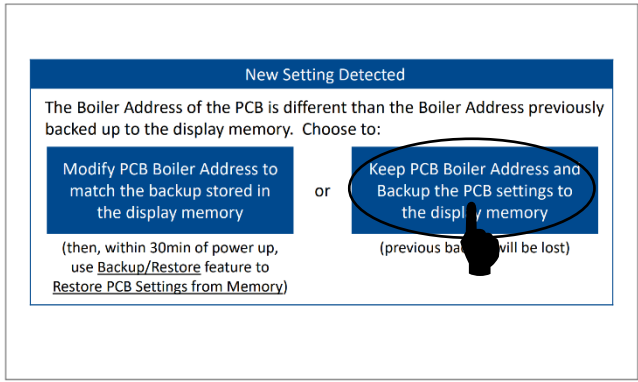
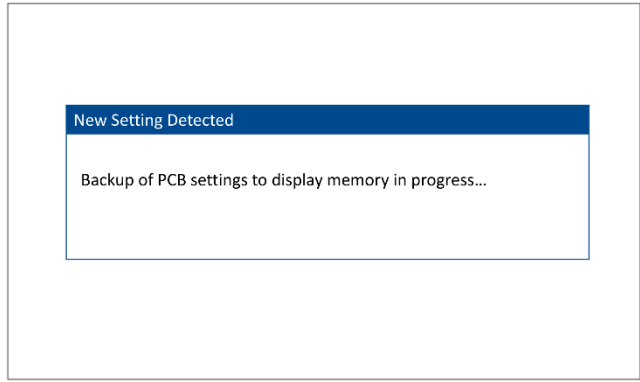
**4** Select the Boiler Address to access the configuration options.

**5** Select from the dropdown menu a unique address for each boiler, i.e., Manager, Follower Boiler 1, 2...7, then select OK.

**6** When the controller starts the reboot sequence, turn the power off.

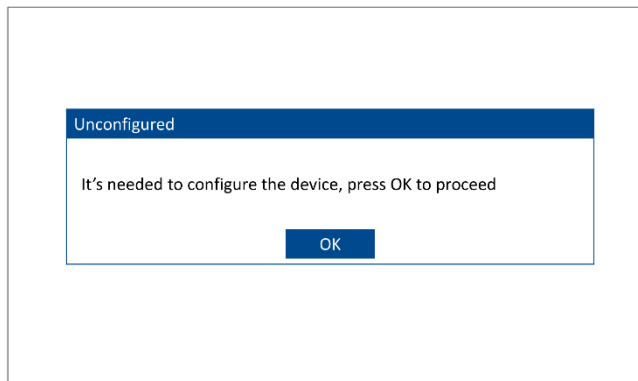
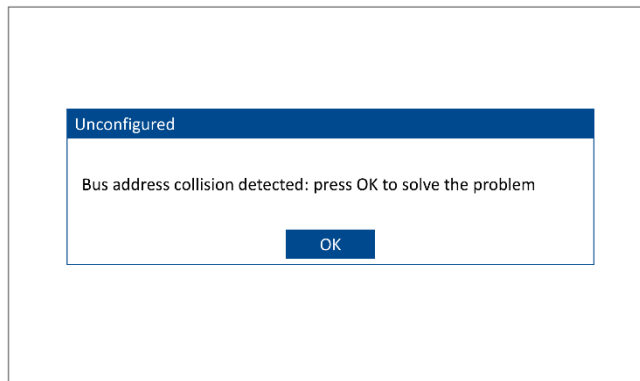
4. **BUS Connection** – with the power turned off to all boilers, wire the BUS connections of each boiler together in parallel (i.e., daisy-chained). Make sure to maintain correct polarity of B and T terminals. See Figure 11-1.
5. **Turn Power On to all Boilers**
  - (if prompted) **Backup the New PCB Settings to the Display Memory** – if the PCB settings had previously been backed up to the display memory, the display will prompt you to back up the new settings, select “Keep PCB Boiler Address and Backup the PCB settings to the display memory”, see Figure 11-4.

**Figure 11-4 Backup PCB Settings (if prompted)**

 <p><b>1</b> Select <b>Keep PCB Boiler Address and Backup....</b></p>	 <p><b>2</b> Wait until backup is complete and the display reboots</p>
--	--

- If an “Unconfigured” message appears on the screen, proceed as described in Figure 11-5.

**Figure 11-5 “Unconfigured” Message**

 <p>Signifies that a Manager is not detected on the BUS, or that the BUS polarity is reversed; check BUS wiring. If problem persists, select OK and confirm that one of the boilers is configured as Manager.</p>	 <p>Confirm the correct configuration of each boiler’s zone controller and that the WiFi cable is removed from all Follower boilers (Figure 11-2), then select OK and confirm that each boiler is set to a unique Boiler Address.</p>
--	---

6. **Configure System Sensor Input** – from the [Sensor Configuration](#) menu of the Manager boiler, set Auxiliary Sensor 1 = System Sensor; see Figure 11-5.

**Figure 11-5 Configuring System Sensor Input**

**1** Select **Setup** from the home screen

**2** Select **Tech Menu** from the Setup menu

**3** Select **Sensor Configuration** from the Tech Menu

**4** Set **Auxiliary Sensor 1** = System Sensor (at Manager boiler only).

7. **Configure Settings**

- [CH Setup](#) and WiFi [Connectivity](#) are managed by the Cascade Manager and need to be set from the display of the Manager boiler via the typical menus; see sections [16.0 DISPLAY MENU GUIDE](#) and [17.0 WIFI CONNECTION](#). Use the [Setup Wizard](#) to have the display walk you through the setup procedure.  
**NOTE:** DHW settings [Tank Setpoint \(Comfort\)](#), [Tank Setpoint \(Reduced\)](#) and [Scheduling](#) are shared for Upstream and Downstream IWHs and are adjusted from the Manager boiler via the [Setup Wizard](#) or the [DHW Setup](#) menu.
- **Downstream IWH** – if the cascade system is heating a Downstream IWH, it is necessary to set the Manager boiler’s [Cascade Setup](#) option [DHW Mode \(Cascade\)](#) = Downstream IWH (Tank Sensor or Aquastat).
- **Upstream IWH** – if connecting an Upstream IWH to an individual boiler configure the respective boiler’s DHW Mode accordingly. To access a Follower boiler’s DHW Mode setting it will be necessary to access parameter x.5.3 from the [Complete Menu](#) (x = 26 for Follower 1; 27 for Follower 2; etc.)  
**NOTE:** For boilers connected to an Upstream IWH, connect the “boiler pump” at *AUX1 PUMP* or *AUX2 PUMP* and set [Pump Control Settings](#) option [Auxiliary Pump 1 Selection](#) (x.7.0) or [Auxiliary Pump 2 Selection](#) (x.7.1) = Cascade Pump. It will be necessary to configure x.7.0 / x.7.1 from the [Complete Menu](#) (x = 24 for Manager; 26 for Follower 1; 27 for Follower 2; etc.)  
**NOTE:** An Upstream IWH cannot be connected to the Manager boiler if the system includes a Downstream IWH.
- **BMS Control** – if using an external signal (0-10V) for modulation control of the Cascade power or setpoint temperature, set Control Mode from the [BMS Control](#) menu of the Manager boiler accordingly.

## 12.0 FIELD WIRING

All wiring must be in accordance with the Canadian Electrical code CSA C22.1 and/or the National Electrical Code ANSI/NFPA 70, local codes, and this manual. NOTICE: the boiler must be electrically grounded. The electrical rating of the TFTN is 120V /1 Phase/60 Hz/12A.



**Power Supply** – the boiler must be powered using a single phase 120VAC power supply that is fused (or protected via a circuit breaker) to allow a maximum of 15 Amps. Failure to follow these instructions may result in component failure, serious injury or death.



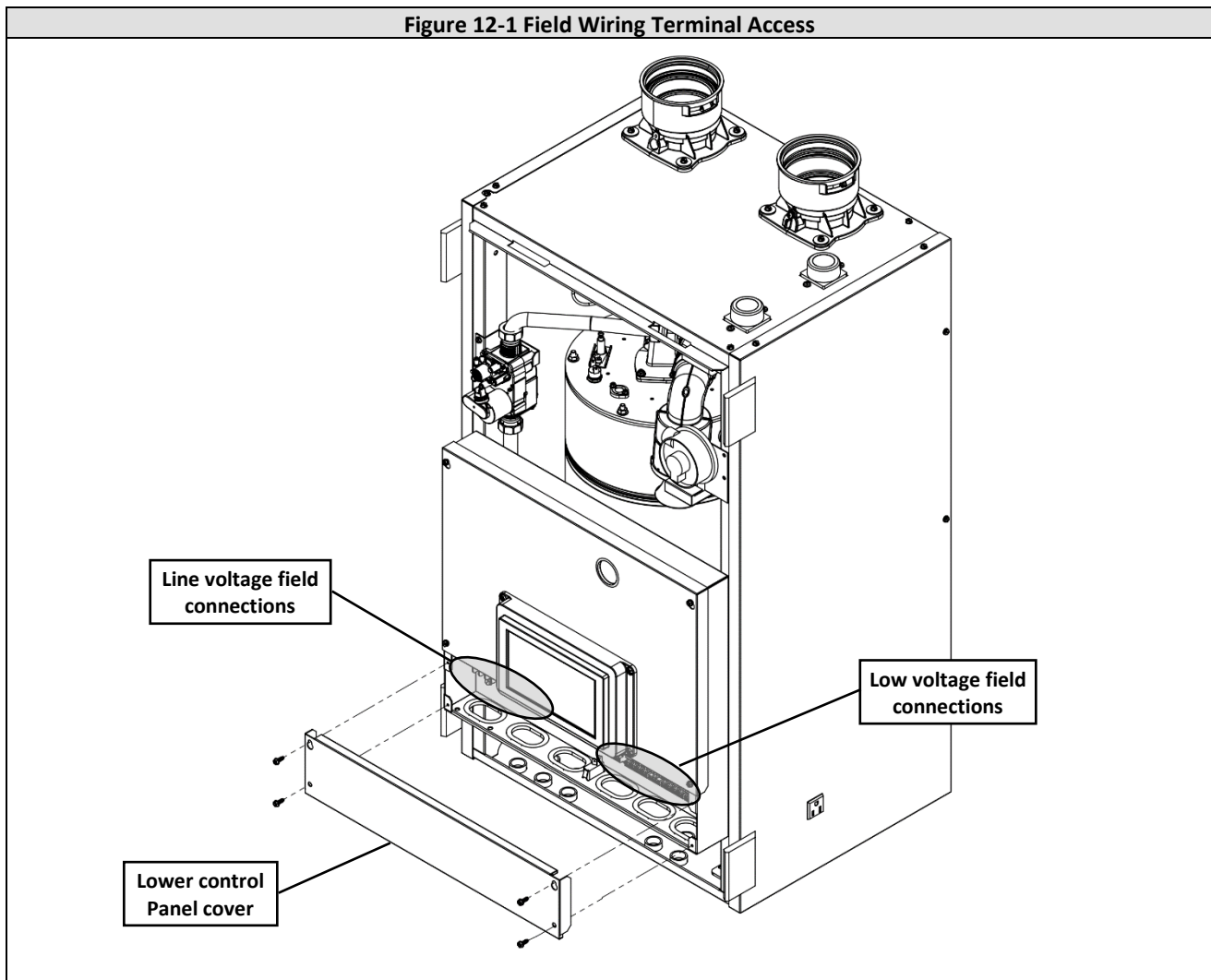
**Avoid Shocks** – To Avoid Electrical Shock, turn off electrical power to the boiler prior to opening any electrical box within the unit. Ensure the power remains off while any wiring connections are being made. Failure to follow these instructions may result in component failure, serious injury or death.

### Wiring Connections

All field wiring connections to the boiler are made at barrier strips located on the TFTN control panel. The connections are accessed by removing the front door of the boiler, followed by the removal of the lower control panel cover; see Figure 12-1. Field wiring enters the cabinet through holes located on the bottom of the boiler cabinet, then must be routed through holes in the bottom of the control panel. Field wiring connections are to be installed in accordance with instructions provided in Tables 12-1 and 12-2, and Figures 12-2 and 12-3.

**NOTE:** protect the wires from stain and chaffing by using suitable strain-relief grommets when passing the wiring through the bottom of the boiler.

Figure 12-1 Field Wiring Terminal Access



**Wire Protection** – When passing wiring through the cabinet of the boiler, the installer must use wire grommets suitable for securing the wiring and preventing chafing. Failure to follow instructions may result in component failure, serious injury or death.



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



**Continuity** – Before connecting the line voltage wiring, perform a continuity check between all wires and ground to make sure that there are no electrical leaks that could blow a fuse or damage electrical components. Also check the polarity of the line and neutral wires. Line must measure 120VAC to ground; neutral must measure zero. Failure to follow instructions may damage the unit.

**Table 12-1 High Voltage Wiring** (Listed in order from left to right)

Connection		Description
BLR PUMP	L	BOILER PUMP 120VAC OUTPUT – powers during all demands except buffer tank charging. Circuit is protected with the main PCB fuses; see Figure 18-4.
	N	
DHW PUMP	L	DHW PUMP 120VAC OUTPUT – powers during DHW tank demands; see Low Voltage Field Connection <i>DHW SWITCH/NTC</i> . Circuit is protected with the main PCB fuses; see Figure 18-4.
	N	
AUX1 PUMP	L	AUX1 PUMP 120VAC OUTPUT – operation is determined by the setting of <a href="#">Pump Control Settings</a> option <a href="#">Auxiliary Pump 1 Selection</a> (24.7.0): <ul style="list-style-type: none"> <li>• None (default) – output does not function.</li> <li>• System Pump – powers during CH demands. Will also power during Downstream IWH demands if <a href="#">DHW Setup</a> -&gt; <a href="#">Advanced Settings</a> option <a href="#">System Pump Activation Logic</a> (24.4.6) = Always Active.</li> <li>• DHW Recirc – powers during DHW Recirc demands; see Low Voltage Field Connection <i>AUX2 NTC</i>.</li> <li>• Buffer Tank – powers during Buffer Tank demands; see Low Voltage Field Connections <i>AUX1 NTC</i> and <i>AUX2 NTC</i>.</li> <li>• Cascade Pump – powers when the boiler is commanded to serve the cascade system (i.e., cascade CH/DHW). Only applicable for a cascaded boiler that is also connected to an Upstream IWH.</li> </ul> Circuit is protected with the main PCB fuses; see Figure 18-4.
	N	
AUX2 PUMP	L	AUX2 PUMP 120VAC OUTPUT – operation is determined by the setting of <a href="#">Pump Control Settings</a> option <a href="#">Auxiliary Pump 2 Selection</a> (24.7.1): <ul style="list-style-type: none"> <li>• None – output does not function.</li> <li>• System Pump (default) – powers during CH demands. Will also power during Downstream IWH demands if <a href="#">DHW Setup</a> -&gt; <a href="#">Advanced Settings</a> option <a href="#">System Pump Activation Logic</a> (24.4.6) = Always Active.</li> <li>• DHW Recirc – powers during DHW Recirc demands; see Low Voltage Field Connection <i>AUX2 NTC</i>.</li> <li>• Buffer Tank – powers during Buffer Tank demands; see Low Voltage Field Connections <i>AUX1 NTC</i> and <i>AUX2 NTC</i>.</li> <li>• Cascade Pump – powers when the boiler is commanded to serve the cascade system (i.e., cascade CH/DHW). Only applicable for a cascaded boiler that is also connected to an Upstream IWH</li> </ul> Circuit is protected with a dedicated 5A fuse at “Zone Outputs/AUX2”; see Figure 18-4.
	N	
LINE	L	Location for connecting Line of the incoming 120VAC power supply.
NEUTRAL	N	Location for connecting Neutral of the incoming 120VAC power supply, and optional Neutral junction for 120VAC loads, e.g., zone pumps.
	N	
ZONE 1		ZONE OUTPUTS – engage when a CH demand is applied to the respective <i>T-STAT</i> input (or via NTI Room Sensor configured to an individual zone). Output voltage is sourced from <i>ZONE INPUT</i> . When the respective zone demand ends, the output will remain powered until <a href="#">Pump Control Settings</a> option <a href="#">Zone Outputs Overrun Time</a> (7.2.8) elapses. Outputs disengage (following the overrun time) when a DHW demand is applied. Each circuit is protected with a dedicated 5A fuse at “Zone Outputs/AUX2”; see Figure 18-4. <b>NOTE:</b> the Zone Outputs Overrun Time can be aborted immediately upon apply a DHW demand, by setting <a href="#">Zone Outputs Overrun During DHW</a> (7.2.9) = Off.
ZONE 2		
ZONE 3		

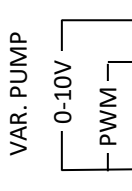
(Continued...)



**Table 12-1 High Voltage Wiring (...Concluded)**

Connection	Description
120V	120VAC POWER SUPPLY – jumper to <i>ZONE INPUT</i> if Zone Outputs loads are 120VAC.
ZONE INPUT	ZONE INPUT POWER – jumper to required power supply for the zone outputs used, i.e., jumper to 120V for zone pumps, or R (24V) for zone valves.
R (24V)	24VAC POWER SUPPLY – jumper to <i>ZONE INPUT</i> if Zone Outputs loads are 24VAC. Circuit is protected with a 2 Amp blade style fuse, located on the Low Voltage Connection PCB; see Figure 18-4.
COMMON	24VAC COMMON – return/neutral leg of 24VAC power supply. Location for connecting return of 24VAC loads, e.g., zone valves.

**Table 12-2 Low Voltage Wiring** (Listed in order from left to right)

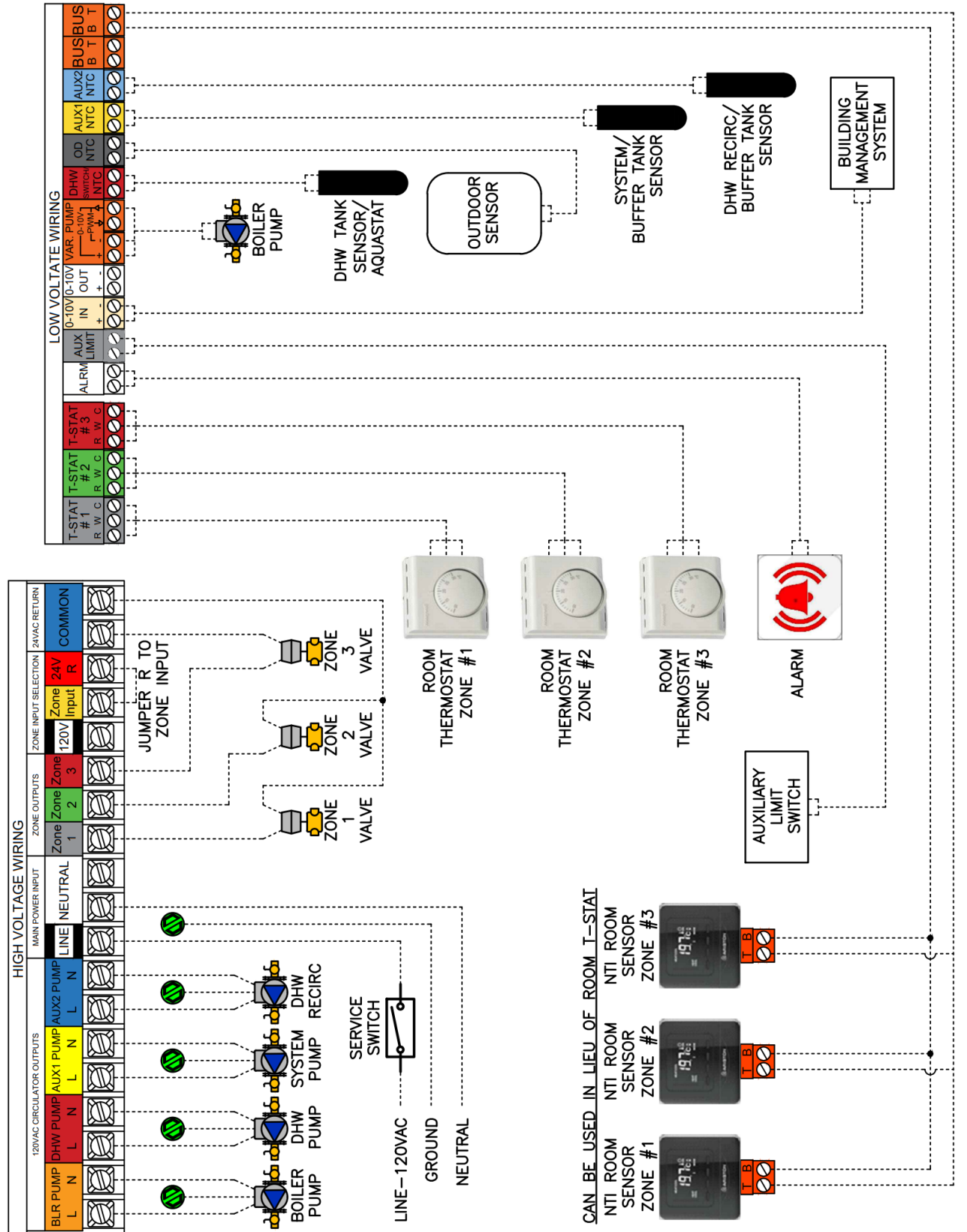
Connection	Description	
T-STAT #1	R	THERMOSTAT INPUT (ZONE 1) – closure of R to W circuit initiates a zone 1 CH demand, activating the <i>ZONE 1</i> output. R = 24VAC Output; W = 24VAC Input; C = Common. Circuit is protected with a 2 Amp blade style fuse, located on the low voltage connection PCB. <b>NOTE:</b> For two-wire devices connect only to R and W (do NOT connect to C).
	W	
	C	
T-STAT #2	R	THERMOSTAT INPUT (ZONE 2) – closure of R to W circuit initiates a zone 2 CH demand, activating the <i>ZONE 2</i> output. R = 24VAC Output; W = 24VAC Input; C = Common. Circuit is protected with a 2 Amp blade style fuse, located on the low voltage connection PCB. <b>NOTE:</b> For two-wire devices connect only to R and W (do NOT connect to C).
	W	
	C	
T-STAT #3	R	THERMOSTAT INPUT (ZONE 3) – closure of R to W circuit initiates a zone 3 CH demand, activating the <i>ZONE 3</i> output. R = 24VAC Output; W = 24VAC Input; C = Common. Circuit is protected with a 2 Amp blade style fuse, located on the low voltage connection PCB. <b>NOTE:</b> For two-wire devices connect only to R and W (do NOT connect to C).
	W	
	C	
ALRM	ALARM CONTACTS (NO) – Contacts close during a lockout or other alarm condition. May be connected to a BMS. Maximum capacity of contacts = 2 Amps at 24VAC.	
AUX LIMIT	AUXILIARY LIMIT (SAFETY LIMIT INPUT) – circuit can be used to connect an external limit device if required by the AHJ. Boiler will produce an a volatile (Auto Reset) safety lockout when circuit is open. Circuit comes factory wired with a jumper – remove jumper if installing an external limit. <b>NOTE:</b> Lockout can be set as Manual Reset “Safety lock non-volatile” via parameter 24.6.5.	
0-10V IN	+	EXTERNAL MODULATION CONTROL (0-10V INPUT) – allows an external control to directly modulate the burner firing rate or adjust the active set point. To activate this input, set <a href="#">BMS Control Control Mode</a> (42.0.0) to the desired control mode, i.e., Voltage Power for firing rate control or Voltage Temp for setpoint control.
	-	
0-10V OUT	+	BURNER POWER OUTPUT SIGNAL (0-10V OUTPUT) – outputs a 0-10V output signal proportional to the operating power of the burner.
	-	
 VAR. PUMP	+	VARIABLE SPEED PUMP CONTROL – the boiler can control a variable speed BOILER PUMP via 0-10V or PWM output signal. For 0-10V control connect to the “+” and “return” (in arrow) terminals. For PWM control connect to the “-”, “return” and “out” (out arrow) terminals. Select the type of pump speed control from <a href="#">Pump Configuration</a> option <a href="#">Boiler Pump Speed Control Signal</a> .
	-	
	↓	
	↑	
DHW SWITCH/NTC	DHW TANK SENSOR OR AQUASTAT – input for a tank sensor or tank thermostat (Aquastat) installed in an Indirect Water Heater (IWH). Tank sensor must be 10k beta = 3977 NTC. A tank sensor is available from NTI (P/N 84632).	
OD NTC	OUTDOOR SENSOR – input for factory supplied outdoor sensor. Reading provides pertinent information to the boiler for automatic temperature adjustment. Alternatively, the outdoor temperature can be sourced from the Internet, if the boiler is connecting to WiFi.	

(Continued...)

Table 12-2 Low Voltage Wiring (...Concluded)

Connection		Description
AUX1 NTC		<p>AUX1 SENSOR INPUT – function is determined by the setting of <a href="#">Sensor Configuration</a> option <u>Auxiliary Sensor 1</u> (24.6.1):</p> <ul style="list-style-type: none"> <li>• System Sensor – input for optional system supply temperature sensor, so that the boiler can directly control the system supply temperature.</li> <li>• Buffer Tank – input for optional buffer tank temperature sensor, so that the boiler can directly control the temperature of an external buffer tank.</li> </ul> <p>Sensor must be 10k beta = 3977 NTC; an optional strap-on System Sensor is available from NTI (P/N 84010).</p>
AUX2 NTC		<p>AUX2 SENSOR INPUT – function is determined by the setting of <a href="#">Sensor Configuration</a> option <u>Auxiliary Sensor 2</u> (24.6.2):</p> <ul style="list-style-type: none"> <li>• DHW Recirc – input for a temperature sensor installed in a DHW recirculation loop, so that the boiler can directly control the heating of a recirculation loop connected to the DHW IWH.</li> <li>• Buffer Tank – input for optional buffer tank temperature sensor, so that the boiler can directly control the temperature of an external buffer tank.</li> </ul> <p>Sensor must be 10k beta = 3977 NTC; an optional strap-on System Sensor is available from NTI (P/N 84010).</p>
BUS	B	<p>BUS COMMUNICATION – provides a link to the communication port of the main PCB of the boiler. Connection is used to connect to other NTI devices such as NTI Room Sensors, NTI Zone Controller (N-Link ZC3), or to cascade to other NTI boilers. Take care to maintain the same polarity of B and T connections at each device.</p>
	T	
BUS	B	
	T	

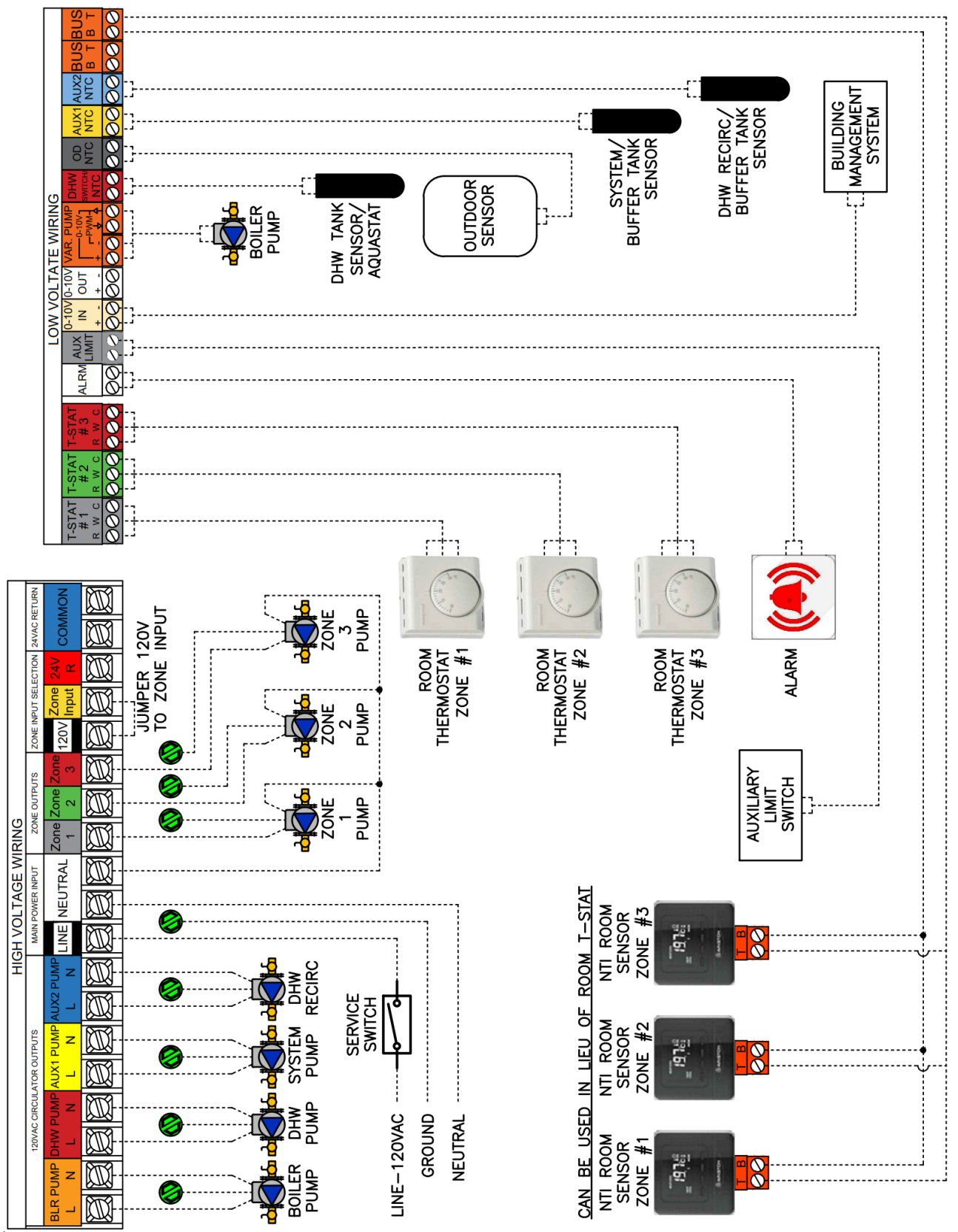
Figure 12-2 Field Wiring Example – 24V Zone Valves



**NOTES:**

1. For ZONE 1-3 to output 24VAC (as illustrated), jumper ZONE INPUT to R (24V).
2. NTI Room Sensors can be used in place of conventional room thermostats. Daisy-chain B & T of each sensor to BUS terminals B & T at the boiler, taking care to match polarity. Each room sensor must be configured for the zone it is located in.
3. Only the BOILER PUMP can be a variable-speed type and controlled by the boiler; figure illustrates 0-10V control.

Figure 12-3 Field Wiring Example – 120V Zone Pumps



- NOTES:**
1. For ZONE 1-3 to output 120VAC (as illustrated), jumper ZONE INPUT to 120V.
  2. NTI Room Sensors can be used in place of conventional room thermostats. Daisy-chain B & T of each sensor to BUS terminals B & T at the boiler, taking care to match polarity. Each room sensor must be configured for the zone it is located in.
  3. Only the BOILER PUMP can be a variable-speed type and controlled by the boiler; figure illustrates 0-10V control.

13.0 WIRING SCHEMATICS

Figure 13-1 Connection Diagram

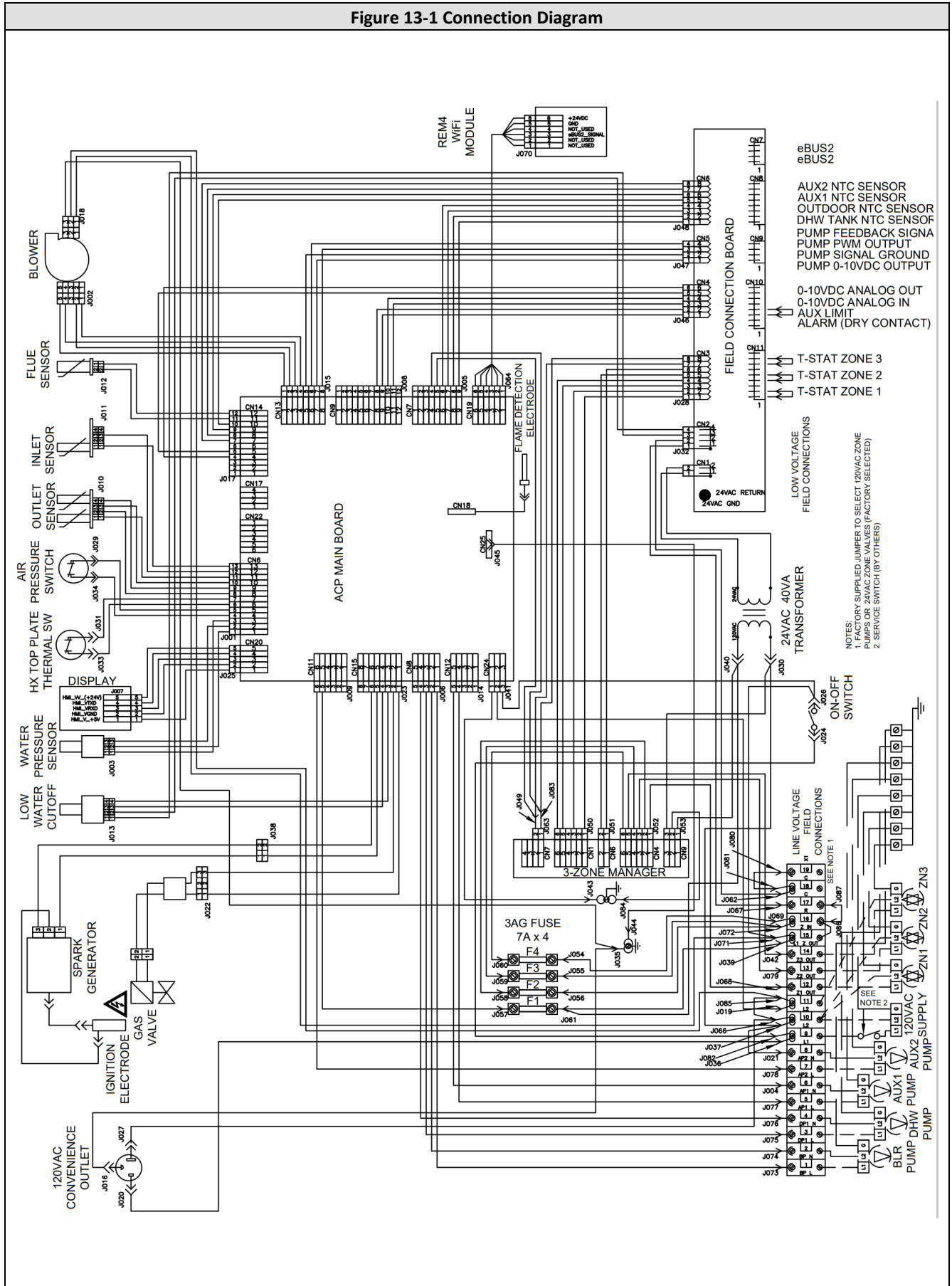
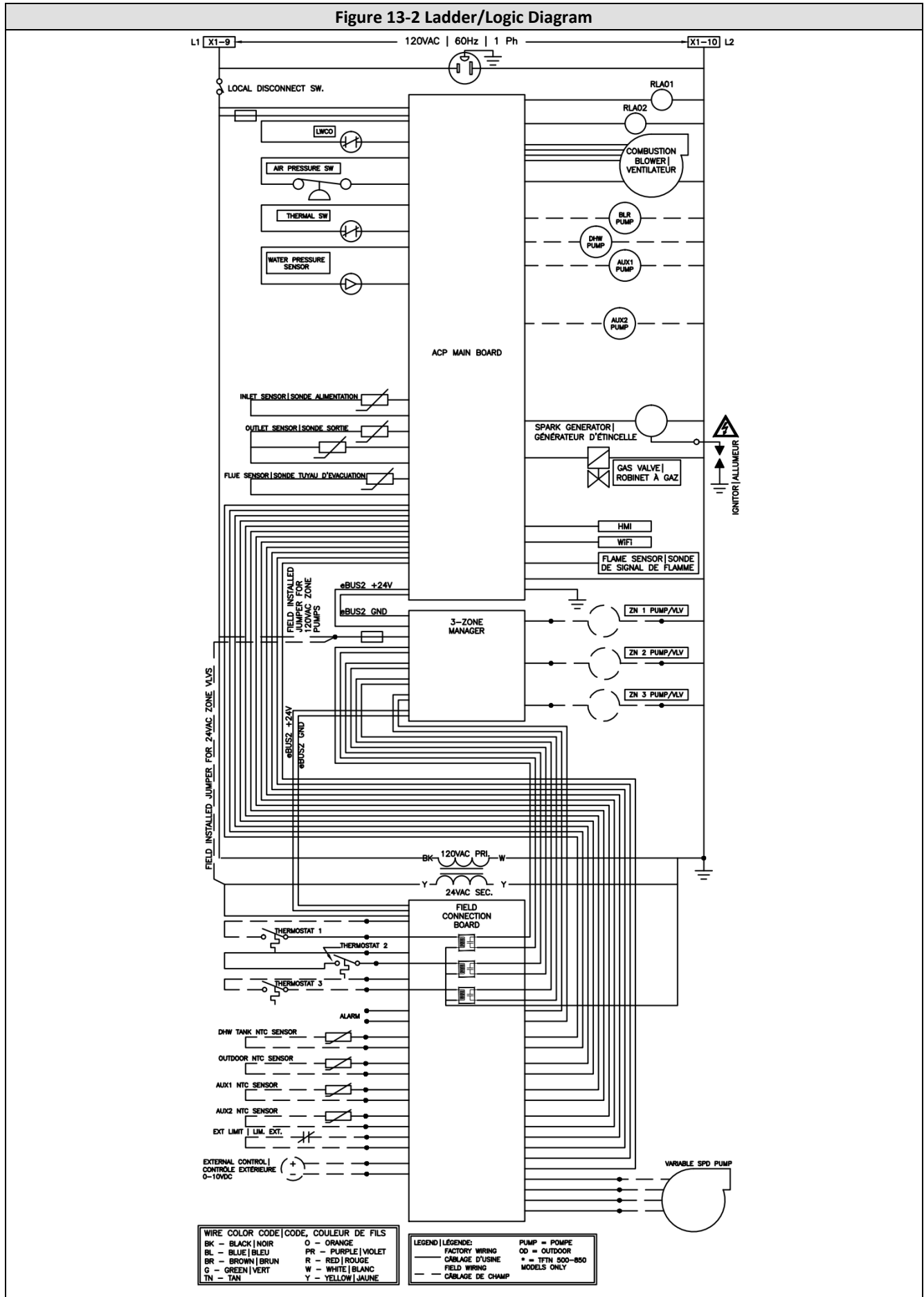


Figure 13-2 Ladder/Logic Diagram



## 14.0 INSTALLATION CHECKLIST

### Installation

- 1. If operating on Propane Gas, convert boiler using the appropriate *Natural to LP Conversion Kit*; see section [1.4 Before Operating with Propane](#).
- 2. Locate the boiler in accordance with section [3.0 BOILER LOCATION](#).
- 3. Install the Exhaust/Air Intake piping in accordance with sections [4.0 GENERAL VENTING](#) and [5.0 VENT/AIR-INLET TERMINATION CLEARANCES](#). Ensure all joints are secured and cemented properly.
- 4. Connect the condensate trap and drain in accordance with section [6.0 CONDENSATE DRAIN](#).
- 5. Connect the gas supply in accordance with section [7.0 INSTALLING GAS PIPING](#).
- 6. Install the plumbing in accordance with section [10.0 BOILER AND HEATING SYSTEM PIPING](#); flush/cleanse the internals of the heating system. Treat system water with Fernox F1 Protector when needed.
- 7. Connect field wiring in accordance with section [12.0 FIELD WIRING](#).
- 8. Advise home/building owner of their responsibilities with respect to maintaining the boiler.



The building owner is responsible for keeping the Exhaust/Air Intake termination free of snow, ice, or other potential blockages and for scheduling boiler routine maintenance as described in the next section. Failure to properly maintain the boiler may result in serious injury or death.

### Start-up



Allow primers/cements to cure for 8 hours prior to Start-up. If curing time is less than 8 hours, first perform the **Mandatory Pre-commissioning Procedure for Plastic Venting**; see section [4.3 Flammable Solvents and Plastic Piping](#). Failure to follow these instructions can result in explosion, serious injury or death.

- 1. Turn gas shut-off valve to the ON position.
- 2. Turn Power on to the boiler.
- 3. Set Controller to the desired settings.
- 4. Turn thermostat up, Ignition will occur.

### Operational Checklist

- 1. System is free of gas leaks.
- 2. System is free of water leaks.
- 3. Water pressure is maintained above 15 PSI.
- 4. All air is purged from the heating system piping.
- 5. Ensure proper water flow rate; unit must not kettle, bang, hiss or flash the water to steam.
- 6. Gas line pressure and combustion readings are in accordance with section [9.0 GAS VALVE AND BURNER SET-UP](#).
- 7. System is free of combustion leaks.
- 8. Unit must operate smoothly.
- 9. Each ignition must be smooth.
- 10. Verify that all condensate lines are clean and drain freely.

### Before Leaving

- 1. Remove line pressure gauge from gas valve, tighten bleed screw, test screw for leaks. See Section 9.0.
- 2. Install plug into the flue gas test port and test for leaks, see Section 9.0.
- 3. Allow the boiler to complete at least one heating cycle, or to operate for at least 15 minutes.
- 4. Always verify proper operation after servicing.

### Instructions to Installing Contractor

- 1. Ensure that the customer receives the Warranty Documentation included with the installation manual.
- 2. Leave the manual with the customer so they know when to call for annual maintenance and inspection.



This boiler must have water flowing through it whenever the burner is firing. Failure to comply may damage the unit, void the warranty, and cause serious injury or death.



Allowing the boiler to operate with a dirty combustion chamber will adversely affect its operation and void the warranty. Failure to clean the heat exchanger on a frequency that matches the need of the application may result in fire, property damage, or death.

## 15.0 ANNUAL MAINTENANCE AND INSPECTION

This unit must be inspected at the beginning of every heating season by a Qualified Technician.

### Annual Inspection Checklist

- 1. Ignition is smooth and consistent, and the combustion fan is noise & vibration free.
- 2. The condensate trap (siphon) and drain piping are cleaned of sediment, and the condensate flows freely. If a condensate neutralizer is utilized, check the pH of the exiting condensate, if below 5 replace the neutralizer media.
- 3. Relief Valve and air vents are not weeping. If a relief valve discharges periodically, this may be due to thermal expansion in a closed water supply system. Correct this situation and **DO NOT PLUG THE RELIEF VALVE!**
- 4. Low water cut off is tested (remove and clean a minimum of once every 5 years, see Section 10.0)
- 5. Examine all venting for evidence of leaks. Ensure vent screens are cleaned and clear of debris.
- 6. Inspect the test port plug and gasket for leakage or signs of failure; replace if leaking or damaged.
- 7. Check the burner plate for signs of leaking.
- 8. The combustion chamber must be cleaned (cleaning frequency based on need for application – see below)
- 9. Keep boiler area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
- 10. Ensure there is nothing obstructing the flow of combustion and ventilation air.  
**Note:** inform the owner about the need to keep the termination unobstructed, including preventing blockage by snow buildup.
- 11. Listen for water flow noises indicating a reduction in boiler water flow rate or scaling.  
**Important** - The hydronic system may need to be flushed to eliminate hard water scale (Use Fernox DS-40 Descaler, NTI p/n: 83450).
- 12. **Verify proper operation after servicing.**

#### CAUTION

**Wiring Labels** - Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

### Combustion Chamber Cleaning Procedure

NTI recommends having the combustion chamber cleaned after the first year of operation, with subsequent cleanings scheduled based on the condition of the combustion chamber at the time. Units operating with LP Gas or in an industrial environment may require more frequent cleanings.

#### IMPORTANT

**Crystalline Silica** - Carefully read the warnings and handling instructions pertaining to Refractory Ceramic Fibers before commencing any service work in the combustion chamber. Take all necessary precautions and use recommended personal protective equipment as required.

### Cleaning Checklist

- 1. Disable the burner (enable/disable button), allow the post-purge cycle to finish and turn gas and power supply off.
- 2. Working inside the cabinet, disconnect the cabling to the fan, gas valve, igniter, flame sensor, and thermal switch.
- 3. Remove the silencer and disconnect the gas line (TFTN285-399: disconnect gas line at the factory supplied union at the inlet to the gas valve; TFTN085-199: remove the gas line between gas valve and mixer).
- 4. Once the combustion chamber has cooled, remove the fan assembly followed by the burner plate – be careful not to damage the insulation disc located underneath the burner plate.
- 5. Use a vacuum to remove any loose debris or dust from inside the burner and combustion chamber.
- 6. **Combustion Chamber:** wet the inside with warm water (do not use any chemicals). Use a garden hose with a trigger nozzle to direct pressurized water through the heat exchanger tubes; the water will exit the bottom via the condensate drain. Continue until the tubes are clear and the water runs clean. Use dry rags or plastic to protect electrical components from being damaged by dripping or spraying water.
- 7. **Siphon:** disassemble and thoroughly clean. Reassemble, taking care that each seal is intact and installed properly; see section [6.0 CONDENSATE DRAIN](#).
- 8. **Burner:** remove from the burner plate; if necessary, clean using compressed air or by immersing in hot water. Dry then reattach to the burner plate; ensure the gasket is in perfect condition and is reinstalled (replace if necessary).
- 9. Inspect the insulation disc located on the under-side of the burner plate. Replace if damaged.
- 10. Re-install the burner plate; be sure the insulation disc is properly aligned. Reinstall remaining components in the opposite order they were removed.
- 11. Perform the Start-up and Operational Checklist detailed in section [14.0 INSTALLATION CHECKLIST](#).

#### WARNING

Replace the insulation disc or any gaskets that show any signs of damage – **DO NOT REUSE**. Failure to follow these instructions may result in fire, property damage or death.



**Refractory Ceramic Fibers (RFC)**



**Personal Protective Equipment Recommended** - Read the following warnings and handling instructions carefully before commencing any service work in the combustion chamber. The insulating material on the inside of the burner plate contains *Refractory Ceramic Fibers* and should not be handled without personal protective equipment.



**Potential Carcinogen** - Use of *Refractory Ceramic Fibers* in high temperature applications (above 1000°C) can result in the formation of Crystalline Silica (cristobalite), a respirable silica dust. Repeated airborne exposure to crystalline silica dust may result in chronic lung infections, acute respiratory illness, or death. Crystalline silica is listed as a (potential) occupational carcinogen by the following regulatory organizations: International Agency for Research on Cancer (IARC), Canadian Centre for Occupational Health and Safety (CCOHS), Occupational Safety and Health Administration (OSHA), and National Institute for Occupational Safety and Health (NIOSH). Failure to comply with handling instructions in Table 15-1 may result in serious injury or death.



**Crystalline Silica** - Certain components confined in the combustion chamber may contain this potential carcinogen. Improper installation, adjustment, alteration, service, or maintenance can cause property damage, serious injury (exposure to hazardous materials) or death. Refer to Table 15-1 for handling instruction and recommended personal protective equipment. Installation and service must be performed by a qualified installer, service agency or the gas supplier (who must read and follow the supplied instructions before installing, servicing, or removing this boiler. This boiler contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans).

**Table 15-1 Handling Instructions for Refractory Ceramic Fibers (RCF)**

Reduce the Risk of Exposure	Precautions and Recommended Personal Protective Equipment
Avoid contact with skin and eyes	<ul style="list-style-type: none"> <li>Wear long-sleeved clothing, gloves, and safety goggles or glasses.</li> </ul>
Avoid breathing in silica dust	<ul style="list-style-type: none"> <li>Wear a respirator with an N95-rated filter efficiency or better. <sup>1</sup></li> <li>Use water to reduce airborne dust levels when cleaning the combustion chamber.</li> <li>Do not dry sweep silica dust. Pre-wet or use a vacuum with a high efficiency filter.</li> </ul>
Avoid transferring contamination	<ul style="list-style-type: none"> <li>When installing or removing RFCs, place the material in a sealable plastic bag.</li> <li>Remove contaminated clothing after use. Store in sealable container until cleaned.</li> <li>Wash contaminated clothing separately from other laundry.</li> </ul>
First Aid Measures	If irritation persists after implementing first aid measures consult a physician. <ul style="list-style-type: none"> <li><b>Skin</b> - Wash with soap and water.</li> <li><b>Eyes</b> - Do not rub eyes, flush with water immediately.</li> <li><b>Inhalation</b> – Breathe in fresh air; drink water, sneeze or cough to clear irritated passageways.</li> </ul>

**Note:**

Respirator recommendations based on CCOHS and OSHA requirements at the time this document was written. Consult your local regulatory authority regarding current requirements for respirators, personal protective equipment, handling, and disposal of RCFs.

For more information on Refractory Ceramic Fibers, the risks, recommended handling procedures and acceptable disposal practices contact the organization(s) listed below:

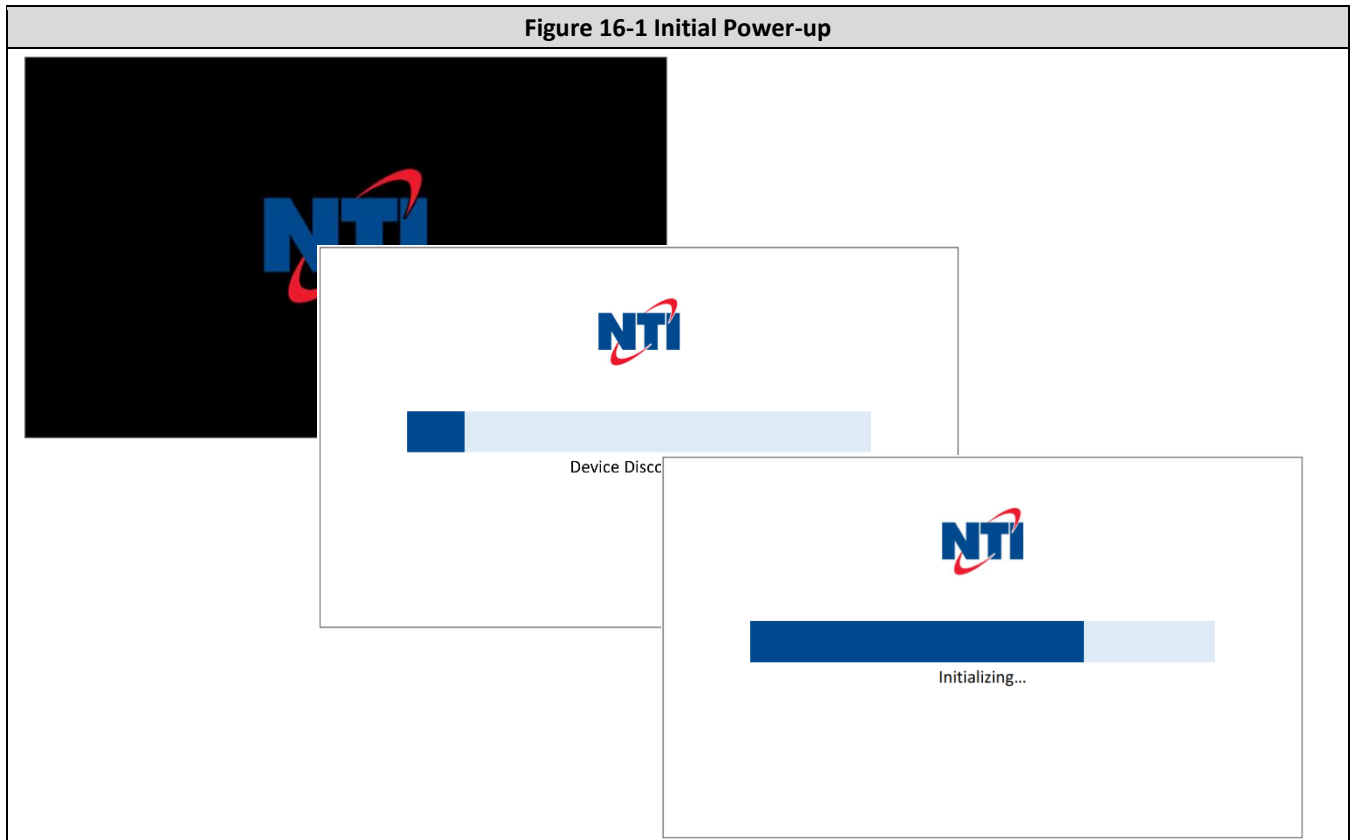
**Canada (CCOHS):** Telephone directory listing under Government Blue Pages Canada—Health and Safety—Canadian Centre for Occupational Health and Safety; or website <http://www.ccohs.ca>.

**United States (OSHA):** Telephone directory listing under United States Government—Department of Labor—Occupational Safety and Health Administration; or website <http://www.osha.gov>.

## 16.0 DISPLAY MENU GUIDE

### Initial Power-up

Immediately following power-up of the boiler, the system will go through a process of “Device Discovery”, where the devices connected to the boiler are discovered. This is followed by an “Initializing” process.



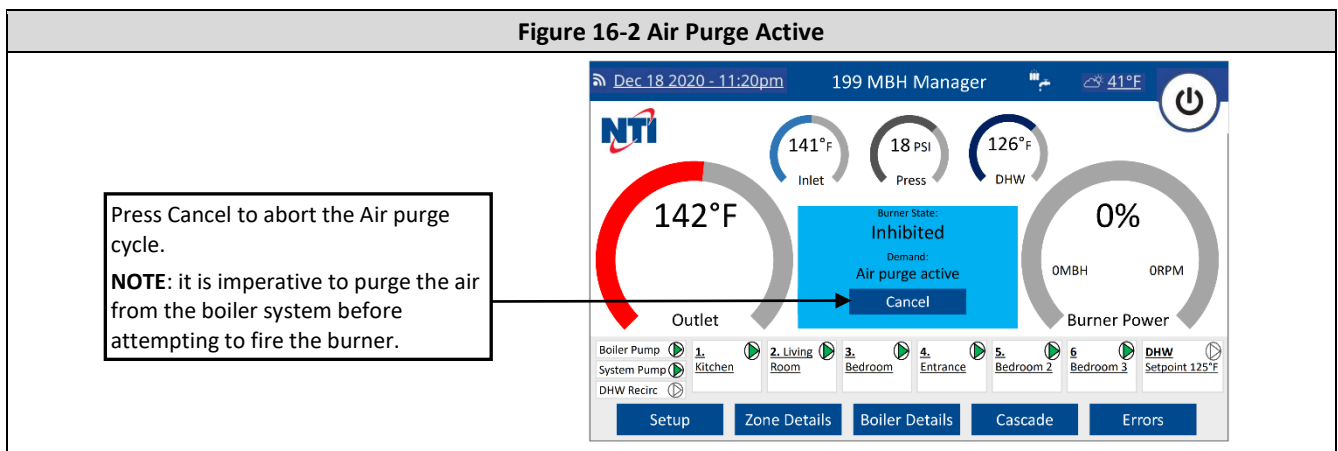
After device discovery and initializing, the controller performs an air purge sequence that is designed to purge air from the boiler water. The air purge sequence cycles the circulators off and on, for a period of 8 minutes, to help free air pockets that may exist in the heat exchanger and boiler piping.

**NOTICE**

The air purge sequence is only initiated following the first power-up of the boiler (or via the [Test Mode](#) menu); if air has already been adequately purged from the system the sequence can be stopped by pressing Cancel, see Figure 16-2.

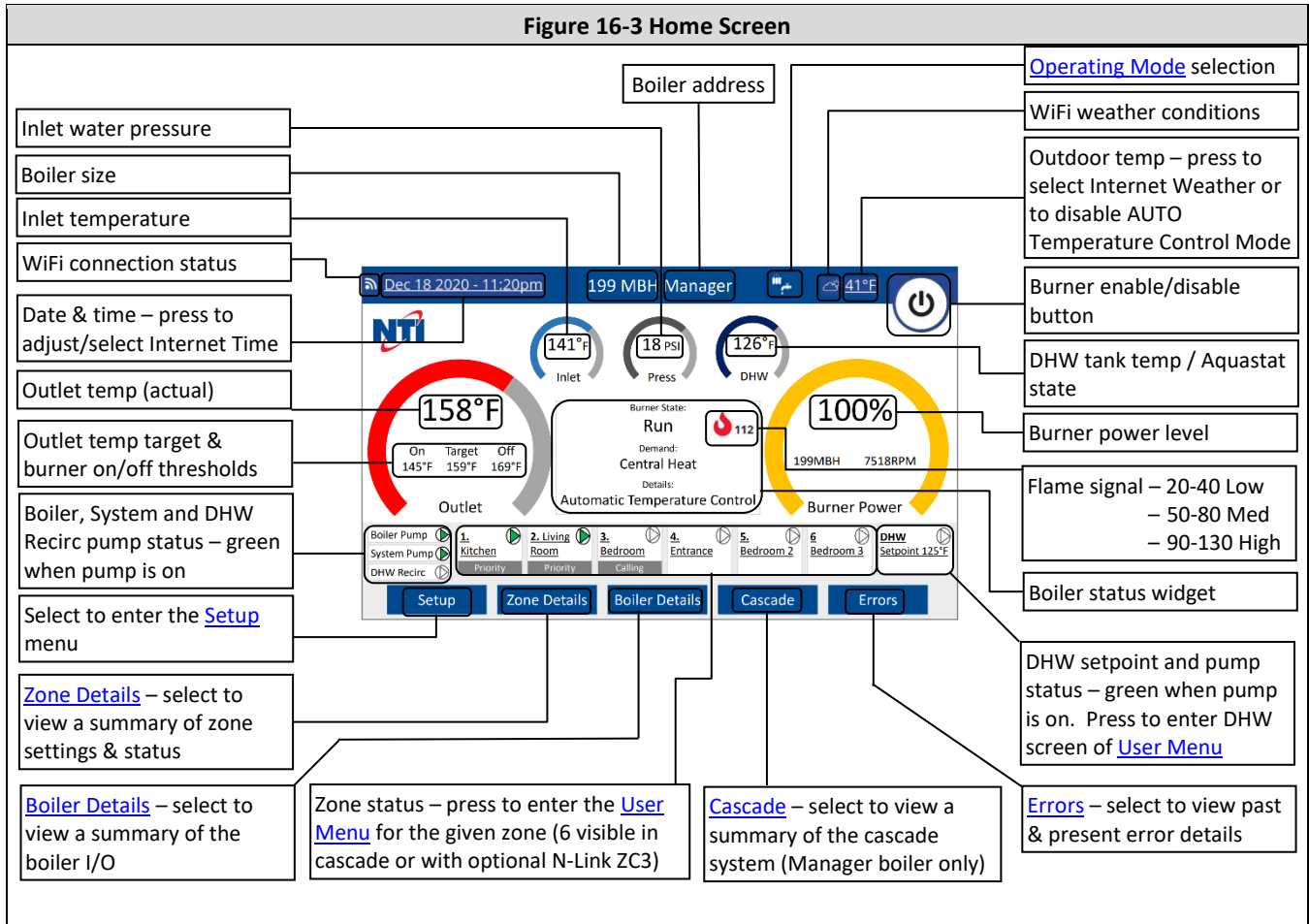
**WARNING**

The air purge sequence is designed to remove air from the system; failure to adequately remove air from the system can damage the heat exchanger and void the warranty and may lead to property damage and personal injury.



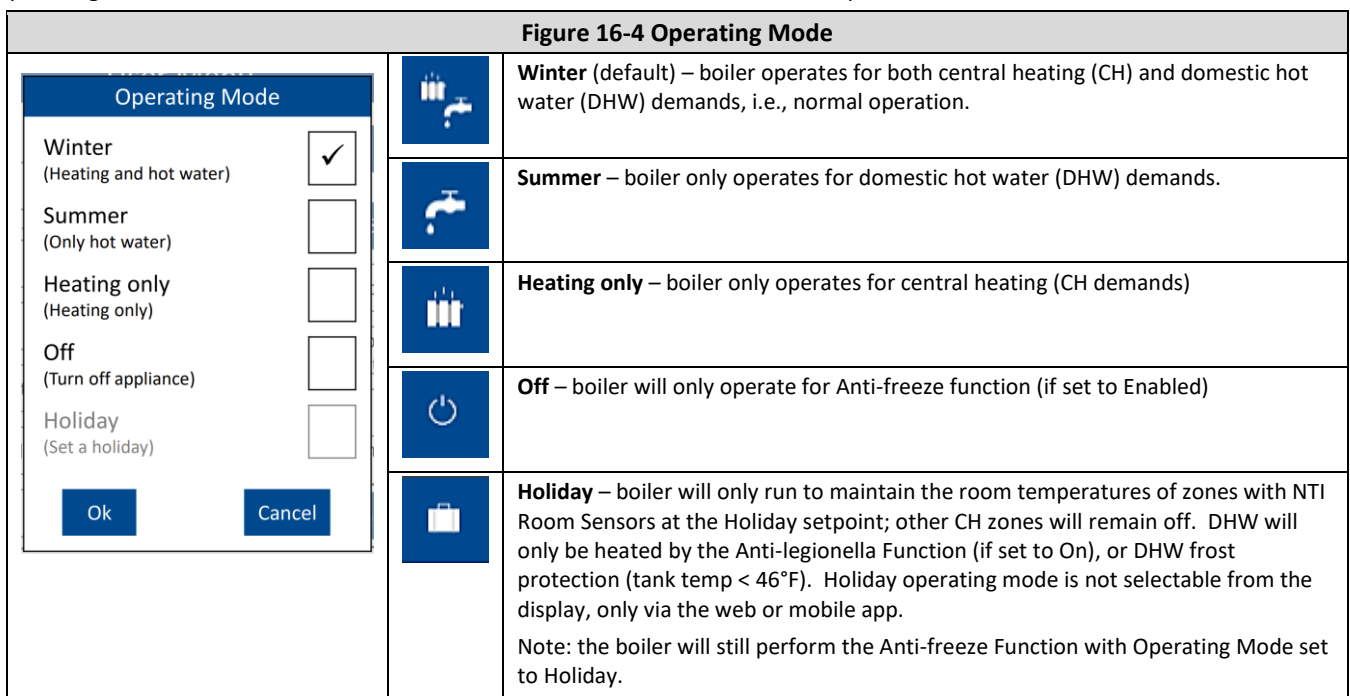
### 16.1 Home Screen

After power-up, following the initialization sequence (see Figure 16-1), the boiler defaults to the Home Screen.



### 16.2 Operating Mode (Scheduling)

Operating mode can be used to select the mode or modes that the boiler will operate for, i.e., CH, DHW, CH & DHW or OFF.



### 16.3 Setup

**Figure 16-5 Setup Menu**

**Setup Wizard** – select to have the system walk you through a step-by-step setup procedure of the controller

**Tech Menu** – select to access all technical parameters

**User Menu** – select to access user adjustable parameters

**Test Mode** – select to access the Burner & Output Test screens or the Air Purge activation button

**Connectivity** – select to view the WiFi settings or to make the WiFi connection

**Diagnostics** – select to access the Statistic, Service and Version menus

#### 16.3.1 Setup Wizard

It is recommended to use the Setup Wizard to walk you through the basic setup of the boiler controller, including CH and DHW setup and connecting the boiler to WiFi.

**Figure 16-6 Setup Wizard**

**1** Select **Setup** from the home screen

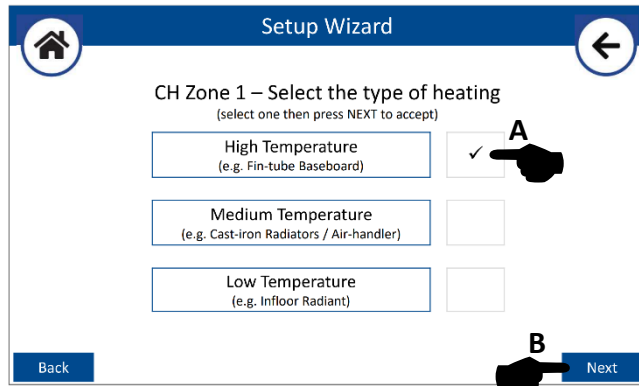
**2** Select **Setup Wizard** from the Setup menu

**3** Insert the password “ntinet” and press **Enter**.

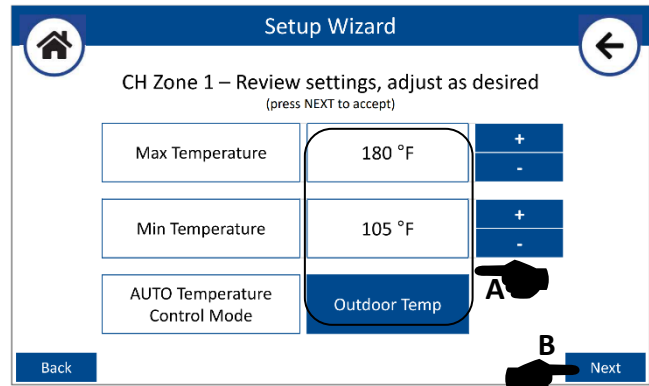
**4** Select the number of heating zones controlled by the boiler (i.e., number of T-STAT inputs used), then press **Next**.

(Continued)

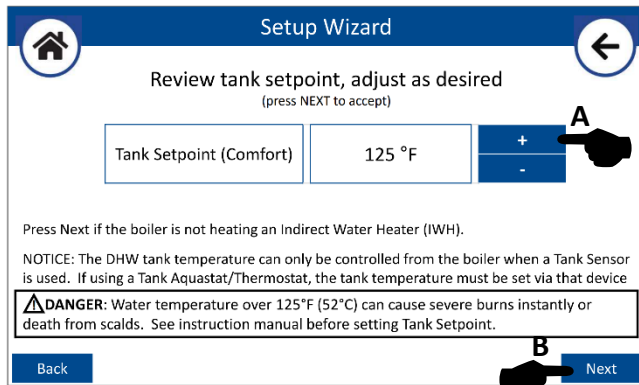
Figure 16-6 Setup Wizard (...Concluded)



5 Select the type of radiation for the 1<sup>st</sup> zone (i.e., zone connected to T-STAT #1 input and ZONE 1 output), then press **Next**.



6 The control will select default settings based on the type of radiation selected, adjust if desired then press **Next**. Note: if the number of heating zones selected was greater than 1, you will be prompted to input the type of radiation for the next zone (step 5).



7 After each CH zone is configured, the wizard will prompt you to set the Tank Setpoint temperature (default = 125°F). Adjust if desired then press **Next**.

**DANGER:** water temperature over 125°F can cause severe burns instantly, or death from scalds. See section [1.6 DHW Temperature Adjustment and Scalding](#)

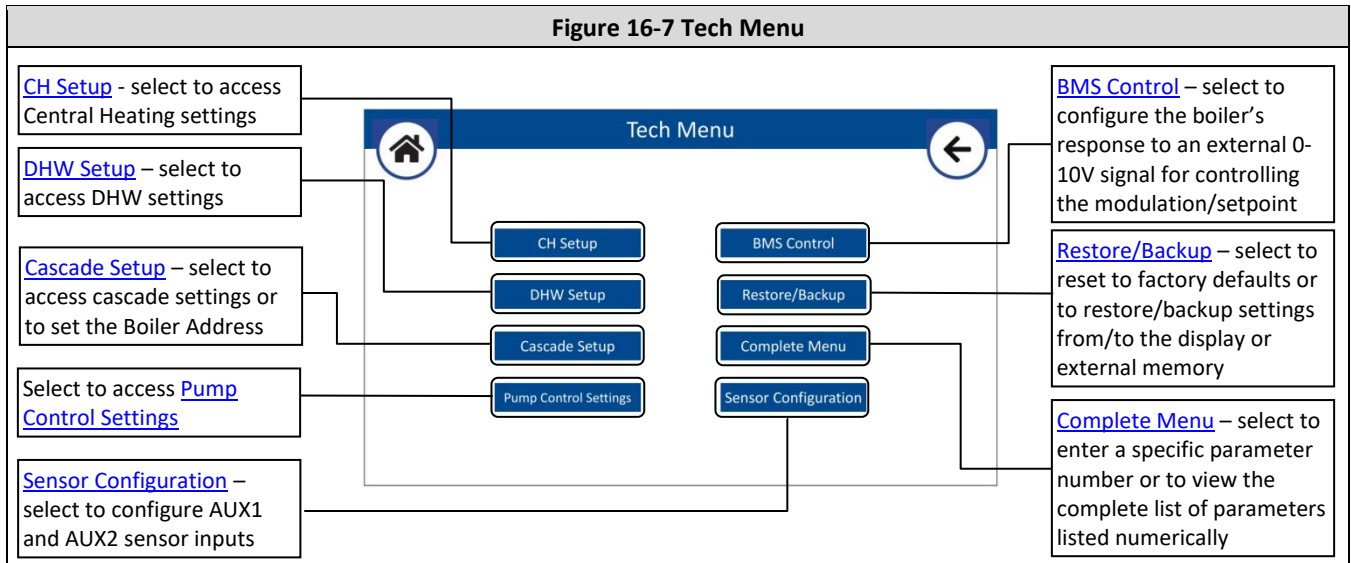


8 Select NO to finish the Setup Wizard or select YES to start the process of connecting the boiler to the internet – see section [17.0 WIFI CONNECTION](#) section. When the boiler is connected the Setup Wizard is complete – select Finish to return to the Home Screen.

### 16.3.2 Tech Menu

All technical parameters of the main controller are accessed from the Tech Menu.

Note: if you have not entered the “ntinet” passcode within the last 30 minutes, you will be asked to enter it again upon selecting Tech Menu; see section [16.3.1 Setup Wizard](#).



### 16.3.2.1 CH Setup

Navigate the Central Heat menus as illustrated in Figure 16-8. Tables 16-1 through 16-5 provide a description of each menu option.

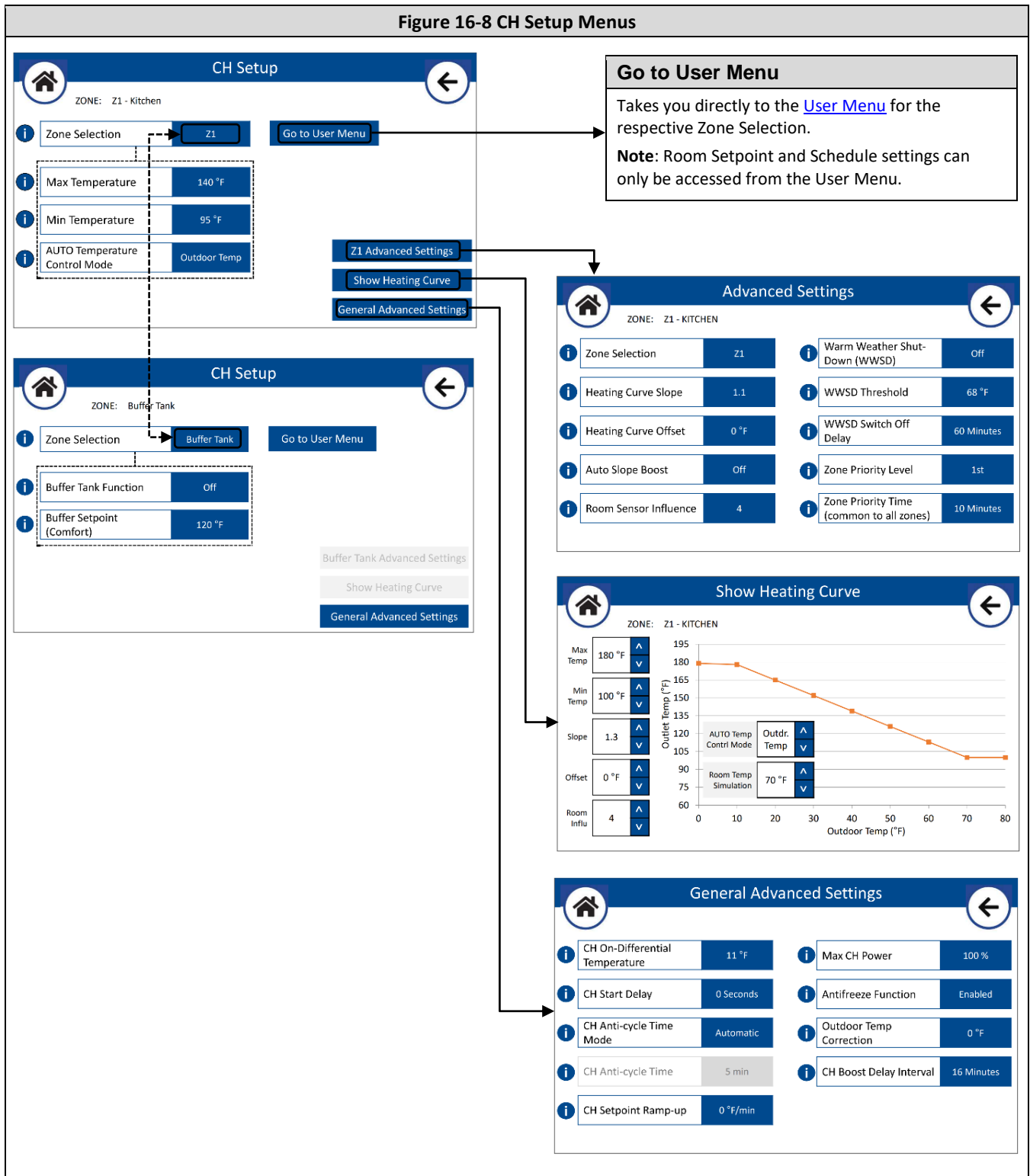


Table 16-1 CH Setup

Setting	Parameter*	Description/Range	Factory Setting
Zone Selection	NA	Allows selection of the zone that you would like to view/modify; options are Z1 (zone 1), Z2, Z3 & Buffer Tank. Options extend to Z4, Z5 & Z6 if using an NTI N-Link ZC3 zone controller.	Z1
Max Temperature	4.2.5	Sets the allowable operating outlet water temperature range of the boiler. (Range = 68-190°F)	140°F
Min Temperature	4.2.6		95°F
AUTO Temperature Control Mode	4.2.1	<p>Sets the type of automatic temperature control for zone 1:</p> <p><b>Fixed Outlet</b> – AUTO Temperature Control is off, boiler operates to the (manually adjustable) Max Temperature setting.</p> <p><b>Basic On/Off</b> – the boiler uses the ON/OFF condition of the room thermostat to boost/reduce the boiler target temperature. With a starting (first time) boiler target temperature of 136°F, the function boosts the target temperature by 7°F every 16 minutes (adjustable via the CH Boost Delay Interval setting) a call for heat is continuously active. Similarly, the target temperature is reduced 7°F every 16 minutes that the heat call is continuously inactive. The temperature will boost/reduce a maximum of 3 times (21°F) for a given thermostat ON/OFF cycle.</p> <p><b>Room Temp</b> – the boiler target temperature automatically adjusts between the Min and Max Temperature Settings, based on the input temperature provided by an optional NTI Room Sensor.</p> <p><b>Outdoor Temp</b> – The boiler target temperature automatically adjusts between the Min and Max Temperature Settings, based on the input temperature provided by the included Outdoor Sensor (or Internet Weather via WiFi connection).</p> <p><b>Room&amp;Outdoor</b> – the boiler target temperature automatically adjusts between the Min and Max Temperature Settings, based upon the input temperatures provided by an optional NTI Room Sensor AND the included Outdoor Sensor (or Internet Weather via WiFi connection).</p>	Outdoor Temp
Buffer Tank Function	20.0.0/ 20.0.7	<p>When enabled, the boiler anticipates the connection of a buffer tank sensor at the <i>AUX1</i> or <i>AUX2 NTC</i> input (configure <a href="#">Sensor Configuration</a> setting <a href="#">Auxiliary Sensor 1 [or 2]</a> accordingly). The boiler operates the burner and buffer tank pump (configure Pump Configuration setting <a href="#">Auxiliary Pump 1 [or 2] Selection</a> accordingly) to maintain the buffer tank temperature at the buffer tank setpoint. CH and Downstream IWH demands are serviced by the buffer tank.</p> <p><b>Off</b> - Buffer Tank Function is disabled.</p> <p><b>Fixed Temperature</b> – the buffer tank setpoint follows the specific <a href="#">Buffer Setpoints</a> (Comfort &amp; Reduced), based on the Scheduling selected.</p> <p><b>Variable Temperature</b> – the buffer tank setpoint follows the greater of the target of the active (or most recent) CH zone demand and the <a href="#">DHW Tank Setpoint</a> (24.5.0) + 9°F (if DHW Mode = Downstream IWH).</p>	Off
Buffer Setpoint (Comfort)	20.0.3	Buffer tank setpoint during Comfort time period. (Range = 50-190°F)	120°F

\* Parameter numbers starting with 4 are for Zone 1; substitute the 4 with a 5 (for Zone 2); 6 (for Zone 3); 14 (for Zone 4); 15 (for Zone 5) or 16 (for Zone 6) for equivalent respect zone parameter.



Table 16-3 CH Setup – Advanced Settings (Applicable to selected zone)

Setting	Parameter*	Range/Description	Factory Setting
Zone Selection	NA	See Table 16-1	Z1
Heating Curve Slope	4.2.2	Sets the slope of the heating curve. The greater the slope, the quicker the boiler target temperature rises as the outdoor temperature decreases. Applicable when AUTO Temperature Control Mode = Outdoor Temp or Room&Outdoor. (Range = 0.2-3.5)	1.1
Heating Curve Offset	4.2.3	See Table 16-14 (a)	0
Auto Slope Boost	4.7.5	Acts to automatically adjust the slope of the heating curve to better match the needs of the heating system. The function boosts the boiler target temperature by increasing the slope 10% every 10 minutes a call for heat is continuously active, to a maximum of 2X the Heating Curve Slope setting. While the heat call is satisfied, the slope decreases by 1% every minute to a minimum equal to the Heating Curve Slope setting.	Off
Room Sensor Influence	4.2.4	Adjusts the influence of room temperature on target boiler temperature – a higher setting causes a greater increase to the boiler target temperature as the indoor temperature drops below room setpoint. Applicable when AUTO Temperature Control Mode = Room Temp or Room&Outdoor. (Range = 0-20)	2
Warm Weather Shutdown (WWSD)	4.1.0	When set to On, disables the zone 1 heating demand when the outdoor temperature exceeds the WWSD Threshold for longer than the WWSD Switch Off Delay time.	Off
WWSD Threshold	4.1.1	Outdoor temperature where the zone 1 heating demand is disabled – if WWSD is set to On. (Range = 32-86°F)	68°F
WWSD Switch Off Delay	4.1.2	Length of time required for the outdoor temperature to exceed the WWSD Threshold before disabling the zone 1 heating demand. (Range = 0-300min)	60 min
Zone Priority Level	4.8.5	Sets the priority level for zone 1. Only zones with the same priority level can operate together. Zones with the highest priority level (lowest numerically) are given the priority first. The priority is switched to the zone with the next highest priority level after the Zone Priority Time elapses. (Range = 1 <sup>st</sup> -3 <sup>rd</sup> )  <b>Note:</b> zones set with the same priority level will run concurrently if being call upon simultaneously. Under this scenario, the boiler will operate to the highest setpoint of the concurrently operating zones.	1 <sup>st</sup>
Zone Priority Time	4.8.6	Length of time that the boiler will service a zone with higher priority, while another zone with lower priority is calling, before switching to service the zone with lower priority. Setting is common to all zones. (Range = 0-1440min)	10 min

\* Parameter numbers starting with 4 are for Zone 1; substitute the 4 with a 5 (for Zone 2); 6 (for Zone 3); 14 (for Zone 4); 15 (for Zone 5) or 16 (for Zone 6) for equivalent respect zone parameter.

**Table 16-4 CH Setup – show Heating Curve** (Applicable to selected zone)

Setting	Parameter*	Range/Description	Factory Setting
Max Temp	4.2.5	Max Temperature; see Table 16-1	140°F
Min Temp	4.2.6	Min Temperature; see Table 16-1	95°F
Slope	4.2.2	Heating Curve Slope; see Table 16-3	1.1
Offset	4.2.3	Heating Curve Offset; see Table 16-14 (a)	0
Room Influ	4.2.4	Room Sensor Influence; see Table 16-3	2
AUTO Temp Contrl Mode	4.2.1	AUTO Temperature Control Mode; see Table 16-1	Outdoor Temp
Room Temp Simulation	NA	Simulates a room temperature for zone 1, to show the impact on the heating curve. Only applicable when using an NTI Room Sensor. (Range = 50-90°F)	70°F

\* Parameter numbers starting with 4 are for Zone 1; substitute the 4 with a 5 (for Zone 2); 6 (for Zone 3); 14 (for Zone 4); 15 (for Zone 5) or 16 (for Zone 6) for equivalent respect zone parameter.

**Table 16-5 CH Setup – General Advanced Settings** (Applicable to all heating zones)

Setting	Parameter	Range/Description	Factory Setting
CH On-Differential Temperature	24.21.1	Determines how much the boiler outlet temperature can drop below target before turning the burner back on. (Range = 0-40°F)	15°F
CH Start Delay	24.21.5	Sets the delay of the initialization of the burner and SYSTEM & BOILER pumps after a central heating call is applied. Can be used to give zone valves an opportunity to fully open. (Range = Disabled/10sec/90sec/210sec)	Disabled
CH Anti-cycle Time Mode	24.21.3	<b>Manual</b> – burner CH anti-cycle time is set manually via setting CH Anti-cycle Time. <b>Automatic</b> – the minimum amount of time burner must remain off between CH burner on cycles is set automatically.	Automatic
CH Anti-cycle Time	24.21.4	With CH Anti-cycle Time Mode set to Manual, determines the minimum amount of time the burner must remain off between CH burner on cycles. (Range = 0-240min)	5 min
CH Setpoint Ramp-up	24.4.4	Limits the rate at which the boiler setpoint temperature increases. Upon receiving a CH request the boiler setpoint is limited to the greater of the minimum setpoint temperature and the current boiler temperature; the setpoint then increases at a rate equal to this setting, until the normal setpoint is achieved. Note: a setting of zero disables this function. (Range = 0-27°F)	0°F/min
Max CH Power	24.0.3	Establishes the maximum power the burner will operate at for CH demands. (Range = 0-100%)	100%
Antifreeze Function	24.20.8	If enabled: <ul style="list-style-type: none"> <li>• when the boiler temp drops below 46°F, the boiler, system and zone pumps are turned on in 2-minute intervals</li> <li>• when the boiler temp drops below 39°F, the burner is operated at min power for 15 minutes, with switch off/on temperatures of 104/95°F</li> </ul>	Enabled
Outdoor Temp Correction	24.4.1	Allows the operator to adjust/offset the outdoor temperature reading in case the reading from the sensor or Internet weather is incorrect. (Range = -10-10°F)	0°F
CH Boost Delay Interval	24.4.2	Sets the time delay between the automatic adjustments of the boiler target temperature in increments of +/- 7°F. Only applicable when the AUTO Temperature Control Mode = Basic On/Off	16 min

### 16.3.2.2 DHW Setup

Navigate the DHW menus as illustrated in Figure 16-9. Tables 16-6 through 16-8 provide a description of each menu option.

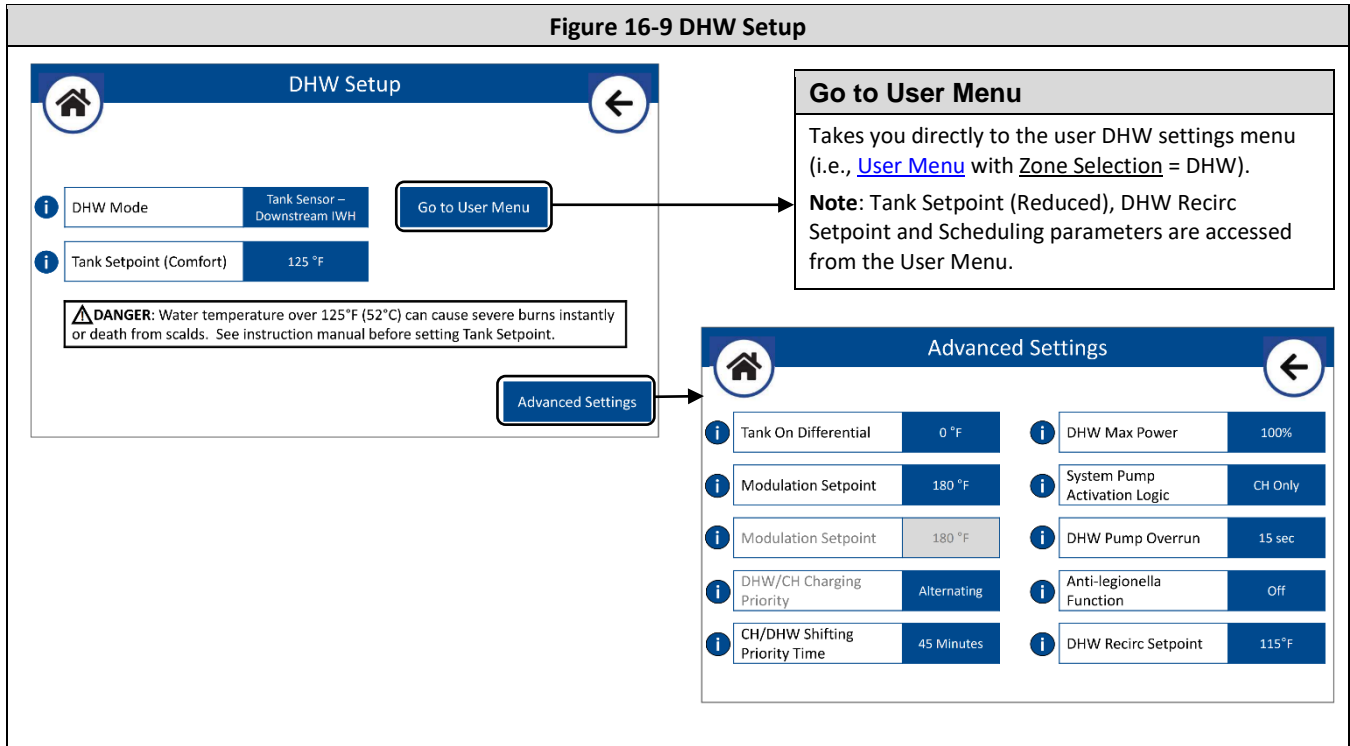


Table 16-6 DHW Setup

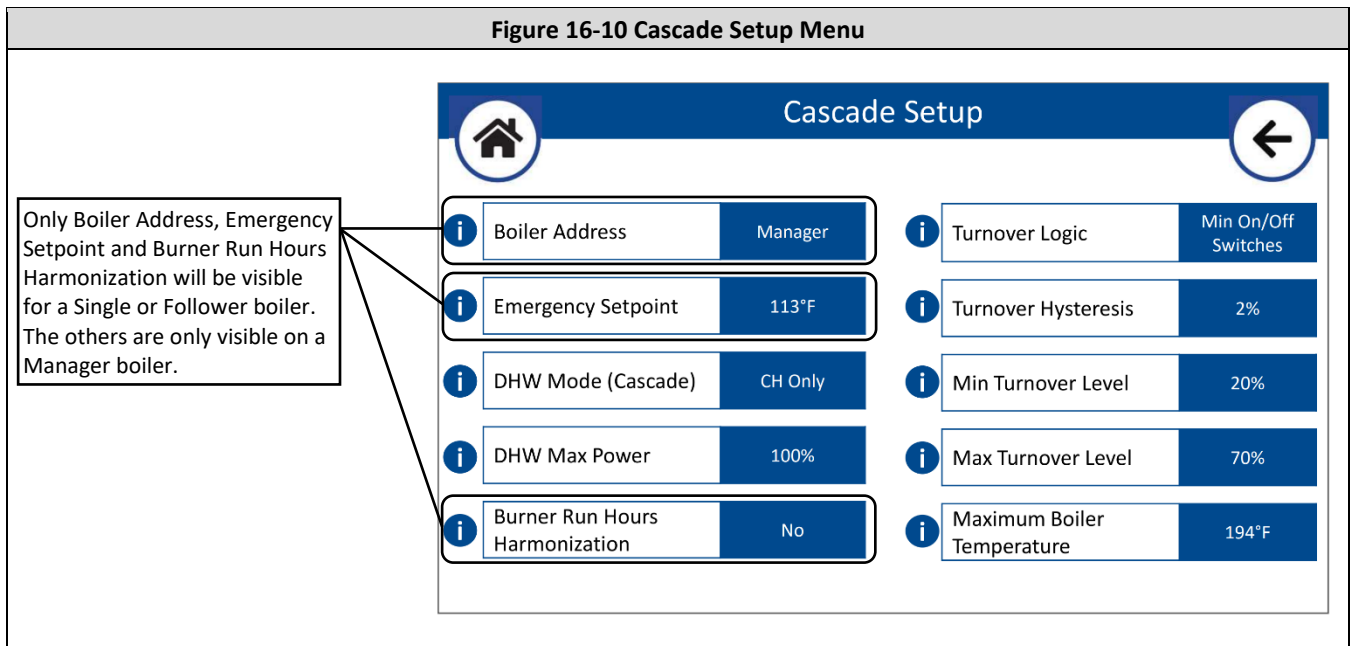
Setting	Parameter	Range/Description	Factory Setting
DHW Mode	24.5.2 24.5.3	Setting defines for the boiler control which is the configuration of the DHW Indirect Water Heater (IWH): <b>Tank Sensor-Upstream IWH</b> – boiler is expecting a temperature sensor reading from an IWH that is located upstream (boiler side) of the hydraulic separator. <b>Aquastat-Upstream IWH</b> – boiler is expecting an on/off switch input from an IWH that is located upstream (boiler side) of the hydraulic separator. <b>Tank Sensor-Downstream IWH</b> – boiler is expecting a temperature sensor reading from an IWH that is located downstream (system side) of the hydraulic separator. <b>Aquastat-Downstream IWH</b> – boiler is expecting an on/off switch input from an IWH that is located downstream (system side) of the hydraulic separator. <b>Off</b> – DHW is disabled Note: the boiler will automatically switch to Tanks Sensor if a sensor is connected to <i>DHW SWITCH/NTC</i> .	Aquastat-Downstream IWH
Tank Setpoint (Comfort)	24.5.0	Establishes the target temperature of the DHW tank (IWH) during Comfort time period. Setting is only applicable when DHW Mode is set to Tank Sensor. (Range = 50-190°F)	125°F

Table 16-8 DHW Setup – Advanced Settings

Setting	Parameter	Range/Description	Factory Setting
Tank On Differential	24.21.0	Sets how much the DHW storage tank temperature can drop below target before initiating a DHW demand. Only applicable when using a Tank Sensor. (Range = 0-36°F)	0
Modulation Setpoint	24.20.0	Boiler outlet water temperature target during DHW demands. (Range = 68-190°F)	180°F
Modulation Setpoint	25.2.7	System water temperature target during DHW demands serviced by a cascade system. Only applicable for Manager boiler, and with DHW configured as Downstream IWH. (Range = 68-190°F)	180°F
DHW/CH Charging Priority	24.5.9	<p><b>Alternating</b> – DHW and CH will not operate simultaneously. Priority switches between DHW and CH at an interval defined by the DHW/CH Shifting Priority Time (first priority is DHW); if set to 0, then DHW has priority indefinitely.</p> <p><b>None-Absolute</b> – DHW and CH operate simultaneously for the period defined by the DHW/CH Shifting Priority Time. After the time elapses, priority switches to DHW until the DHW request ends.</p> <p><b>None</b> – DHW and CH can operate simultaneously indefinitely. Only applicable for DHW Mode configured as Downstream IWH; Upstream IWH configuration always functions as Alternating</p>	Alternating
DHW/CH Charging Priority Time	24.4.8	Determines how long a CH or DHW demand can last before the priority is switched. A value of 0 keeps the priority with DHW indefinitely. (Range = 0-720min)	45 min
System Pump Activation Logic	24.4.6	<p><b>Always Active</b> – SYSTEM PUMP output (AUX2) turns on for both CH and DHW demands (with DHW Mode set to Downstream).</p> <p><b>CH Only</b> – SYSTEM PUMP output (AUX2) only turns on for CH demands.</p>	CH Only
DHW Pump Overrun Time	24.3.6	Sets the length of time the DHW PUMP output operates after a DHW demand is satisfied. (Range = 0-255sec)	15sec
Anti-legionella Function	24.5.4	This function prevents the formation of Legionnaires’ disease bacteria which may develop in piping and IWHs at temperature between 68°F and 104°F. When set to On, if the IWH temperature stays below 138°F for over 100 hours, the boiler will heat the water in the IWH until it reaches 149°F for 30 minutes. Only applicable when a Tank Sensor is used.	Off
DHW Recirc Setpoint	24.20.6	See Table 16-14 (c)	115°F
Scheduling (DHW Recirc)	24.5.7 & 24.5.8		Always Active

### 16.3.2.3 Cascade Setup

The Cascade Setup menu must be accessed to set the Boiler Address of each boiler that will be configured as part of a cascade system; see section [11.0 CASCADE INSTALLATION](#). Once the cascade system is configured, the Cascade Setup menu of the Manager boiler can be accessed to modify the operation of the cascade system. For Follower boilers in cascade, the Cascade Setup menu can be accessed to modify the Emergency Setpoint or Burner Run Hours Harmonization settings.



**Table 16-9 Cascade Setup**

Setting <sup>1</sup>	Parameter <sup>2</sup>	Range/Description	Factory Setting
Boiler Address	0.4.6	<p>Establishes the configuration and role of the given boiler on the communication BUS:</p> <p><b>Unconfigured</b> – boiler will only operate in Emergency mode. Boilers connected on the communication BUS, without one configured as Manager, will eventually default to Unconfigured. Default setting for replacement controllers.</p> <p><b>Single Boiler</b> – for "stand alone" boilers, that are not connected to other boilers via the communication BUS.</p> <p><b>Manager Boiler</b> – for the managing boiler in a cascade of multiple boilers. Only one boiler in a cascade can be configured as Manager.</p> <p><b>Follower Boiler 1...7</b> – for non-managing boilers in a cascade of multiple boilers. Each Follower in the cascade must have a unique address, i.e., 1...7.</p> <p>Note: for boilers already configured as a Follower Boiler, setting options Single Boiler and Manager Boiler will not be available. To make them available, first set the Follower Boilers as Unconfigured and disconnect it from other boilers on the BUS.</p>	Single Boiler
Emergency Setpoint	24.0.7/ 26...32.0.7	Sets the boiler operating temperature when there is a malfunction of the BUS circuit. Applicable for Unconfigured and Follower boilers when the cascade Manager is not connected on the BUS.	113°F

(Continued...)

Table 16-9 Cascade Setup (...Concluded)

Setting <sup>1</sup>	Parameter <sup>2</sup>	Range/Description	Factory Setting
DHW Mode (Cascade)*	25.2.2	Applicable to an IWH that is installed downstream (system side) of the hydraulic separator, which is serviced by the entire cascade. Set as <u>CH Only</u> if there isn't a downstream IWH serviced by the entire cascade. <b>CH Only</b> – cascade system will not service the DHW request. <b>Tank Sensor</b> – cascade manager is expecting a temperature sensor reading from a Downstream IWH. <b>Aquastat</b> – cascade manager is expecting an on/off switch input from a Downstream IWH located	CH Only
DHW Max Power*	25.0.1	Establishes the maximum power the total cascade will operate at for DHW demands.	100%
Burner Run Hours Harmonization	24.9.4/ 26...32.9.4	Sets the burner run hours statistics to equal the average of the other boilers in the cascade. Perform this function <b>ONLY</b> on the boiler where the PCB has just been replaced. Settings is not applicable for Single boilers.	No
Turnover Logic*	25.0.2	Sets the power division algorithm for the cascade. <b>Min Off-On Switches</b> – when more than one boiler is servicing the demand, one is subtracted (switched off) when the required power is less than the sum of the active boilers operating at the Min Turnover Level. Generally, results in a greater number of boilers operating at a lower power level. <b>Max Power Division</b> – when more than one boiler is servicing the demand, one is subtracted (switched off) when the required power could be achieved by one fewer boilers operating at or below the Max Turnover Level. Generally, results in a fewer number of boilers operating at a higher power level. In each scenario a new boiler is added (switched on) when the required power is greater than the sum of the active boilers operating at the Max Turnover Level.	Min Off-On Switches
Turnover Hysteresis*	25.0.3	Sets the amount the required power level must drop below <u>Min Turnover Level</u> before a boiler is switched off. See <u>Min Turnover Level</u> . (Range = 0-20%)	2%
Min Turnover Level*	25.0.4	Sets the minimum power level for multiple boilers operating together in a cascade. If the required power is less than the sum of the active boilers operating at the Min Turnover Level (less the Turnover Hysteresis) a boiler is switched off. To avoid short cycling, ensure the Min Turnover Level is set to less than half of the Max Turnover Level setting. Only applicable when Turnover Logic = Min Off/On Switches. (Range = 20-MaxTurnoverLevel)	35%
Max Turnover Level*	25.0.5	Sets the maximum power level for operable boilers when not all boilers in cascade are switched on. If the required power is greater than the sum of the active boilers operating at the Max Turnover Level, then the next boiler is switched on. (Range = MinTurnoverLevel-100%)	60%
Maximum Boiler Temperature*	25.0.6	Establishes the maximum permissible operating temperature for the individual cascade boiler. Higher temperatures will cause the individual boiler to switch off. (Range = 68-199°F)	199°F

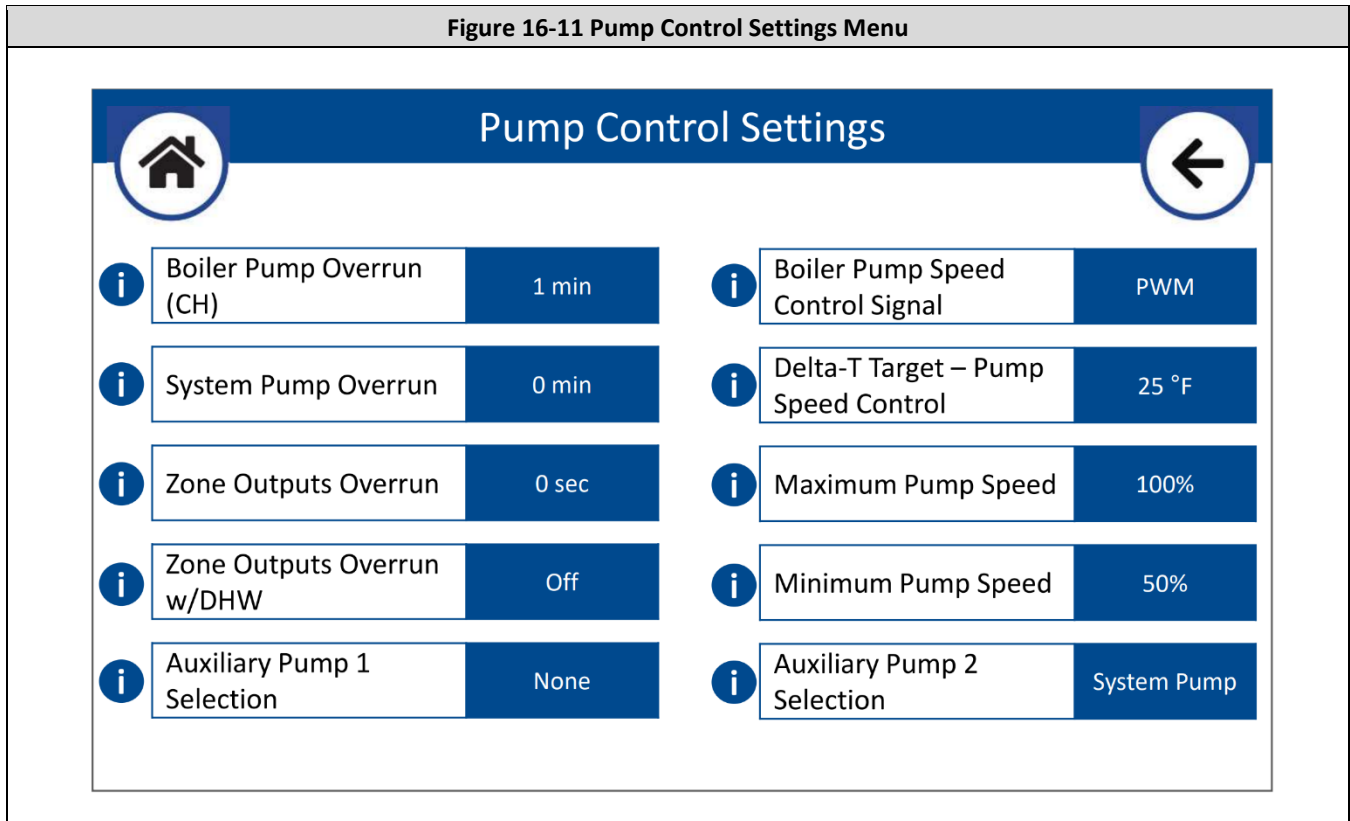
Notes:

- Settings marked with an asterisk (\*) are only applicable for the Manager boiler.
- The parameter number for some Follower boiler settings will begin with 26-32 (instead of 24 or 25); 26 for Follower Boiler 1, 27 for Follower Boiler 2 and so on. Follower boiler settings are available from the “NTI net” webapp, and from the [Complete Menu](#) of the Manager boiler by entering the applicable parameter number.

### 16.3.2.4 Pump Control Settings

Access the Pump Control Settings screen to set the overrun time of the boiler, system, and zone pump outputs, configure *AUX1* & *AUX2 PUMP* outputs, or to setup the variable speed pump control.

**Note:** the overrun time for the DHW pump output is configured from the [DHW Setup](#) -> [Advanced Settings](#) screen.



**Table 16-10 Pump Control Settings**

Setting	Parameter	Range/Description	Factory Setting
Boiler Pump Overrun (CH)	24.3.2	Sets the post circulation time for the boiler pump following a CH demand. (Range = 0-255; 255 = Always on)	1 min
System Pump Overrun	24.4.5	Sets the post circulation time for the system pump following a demand. (Rang = 0-255sec) <b>NOTE:</b> do not set <u>System Pump Overrun</u> time higher than the <u>Zone Outputs Overrun</u> time.	0 sec
Zone Outputs Overrun	7.2.8	Sets how long the zone outputs remain energized following the end of the respective zone demand. (Range = 0-7200sec) <b>NOTE:</b> do not set <u>Zone Outputs Overrun</u> time lower than the <u>System Pump Overrun</u> time.	0 sec
Zone Outputs Overrun During DHW	7.2.9	<b>On</b> – allows the Zone Outputs Overrun to occur during a concurrent DHW demand. <b>Off</b> – the Zone Outputs Overrun is aborted if a DHW demand occurs.	Off

(Continued...)

Table 16-10 Pump Control Settings (...Concluded)

Setting	Parameter	Range/Description	Factory Setting
Auxiliary Pump 1 Selection	24.7.0	<p>Sets the functionality of output <i>AUX1 PUMP</i>.</p> <p><b>System Pump</b> – powers during CH demands. Will also power during Downstream IWH demands if <u>System Pump Activation Logic</u>, in the <u>Advanced Settings</u> screen of the <u>DHW Setup</u> menu, is set as Always Active.</p> <p><b>DHW Recirc</b> – powers during DHW Recirc demands; see setting <u>Auxiliary Sensor 2</u> in the <u>Sensor Configuration</u> menu for setup of a DHW Recirc sensor.</p> <p><b>Buffer Tank</b> – powers during Buffer Tank demands; see settings <u>Auxiliary Sensor 1</u> and <u>Auxiliary Sensor 2</u> in the <u>Sensor Configuration</u> menu for setup of a Buffer Tank sensor.</p> <p><b>Cascade Pump</b> – powers when the boiler is commanded to serve the cascade system (i.e., cascade CH/DHW). Only applicable for a cascaded boiler that is also connected to an Upstream IWH.</p>	None
Boiler Pump Speed Control Signal	24.3.4	<p>Sets the type of signal that the boiler will output to drive the speed of a variable speed boiler pump to achieve a delta-T equal to the <u>Delta-T Target - Pump Speed Control</u> setting.</p> <p><b>0-10V</b> – connect to <i>VAR. PUMP</i> terminals "+" and "return" (in arrow).</p> <p><b>PWM</b> – connect to <i>VAR. PUMP</i> terminals "-", "return" and "out" (out arrow).</p>	PWM
Delta-T Target – Pump Speed Control	24.3.5	<p>Sets the delta-T target for the boiler when using <u>Boiler Pump Speed Control Signal</u> to control the speed of a variable speed boiler pump. (Range = 5-45°F)</p>	25°F
Maximum Pump Speed	24.3.0	<p>Sets the maximum control signal to the boiler pump when using <u>Boiler Pump Speed Control Signal</u> to control the speed of a variable speed boiler pump. (Range = MinimumPumpSpeed-100%)</p>	100%
Minimum Pump Speed	24.3.1	<p>Sets the minimum control signal to the boiler pump when using <u>Boiler Pump Speed Control Signal</u> to control the speed of a variable speed boiler pump. (Range = 20%-MaximumPumpSpeed)</p>	50%
Auxiliary Pump 2 Selection	24.7.1	<p>Sets the functionality of output <i>AUX2 PUMP</i>.</p> <p><b>System Pump</b> – powers during CH demands. Will also power during Downstream IWH demands if <u>System Pump Activation Logic</u>, in the <u>Advanced Settings</u> screen of the <u>DHW Setup</u> menu, is set as Always Active.</p> <p><b>DHW Recirc</b> – powers during DHW Recirc demands; see setting <u>Auxiliary Sensor 2</u> in the <u>Sensor Configuration</u> menu for setup of a DHW Recirc sensor.</p> <p><b>Buffer Tank</b> – powers during Buffer Tank demands; see settings <u>Auxiliary Sensor 1</u> and <u>Auxiliary Sensor 2</u> in the <u>Sensor Configuration</u> menu for setup of a Buffer Tank sensor.</p> <p><b>Cascade Pump</b> – powers when the boiler is commanded to serve the cascade system (i.e., cascade CH/DHW). Only applicable for a cascaded boiler that is also connected to an Upstream IWH</p>	System Pump

16.3.2.5 BMS Control

Access the BMS Control screen to configure the boiler to allow control of the burner firing rate or temperature setting from an external device, i.e., 0-10V signal applied to *0-10V IN*, or communication through the *BUS* connection from a 3<sup>rd</sup> party BMS via NTI BMS Gateway P/N: 3260186.

**Note:** BMS Control is only applicable for CH demands – not DHW demands. For cascade systems, the external input must be applied to the Manager boiler. Use of external control (0-10V or External) disables the boiler’s 3-zone controller.



Figure 16-12 BMS Control Menu

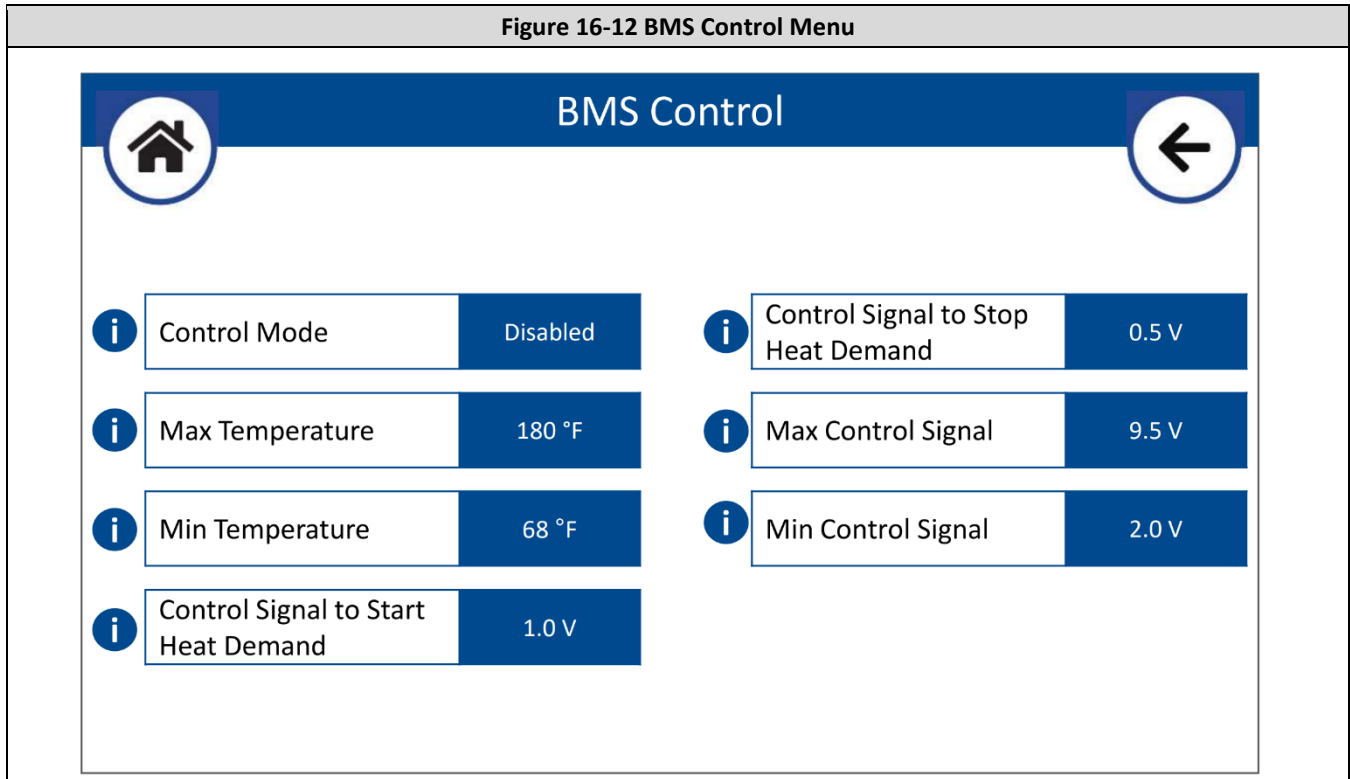


Table 16-11 BMS Control

Setting	Parameter	Range/Description	Factory Setting
Control Mode	42.0.0	<b>Disabled</b> – the boiler maintains control of the burner power and setpoint temperature. <b>0-10V (Power or Temp)</b> – the boiler power level, or setpoint temperature, is modulated proportionally to the 0-10V IN signal. <b>External controller (power or temp)</b> – the boiler power level, or setpoint temperature, is controlled directly by a BMS communicating through the NTI BMS Gateway (3260186) connected to the BUS.	Disabled
Max Temperature	42.0.1	Sets the maximum boiler temperature, corresponding to an input signal equal to the <u>Max Control Signal</u> , when <u>Control Mode</u> is configured to 0-10V / Temp. (Range = <u>Min Temperature</u> to 190°F)	180°F
Min Temperature	42.0.2	Sets the minimum boiler temperature, corresponding to an input signal equal to the <u>Min Control Signal</u> , when <u>Control Mode</u> is configured to 0-10V / Temp. (Range = 68°F to <u>Max Temperature</u> )	68°F
Control Signal to Start Heat Demand	42.1.0	Sets the minimum input control signal required to start a heat demand. (Range = <u>Control Signal to Stop Heat Demand</u> to <u>Min Control Signal</u> )	1.0V
Control Signal to Stop Heat Demand	42.1.1	Sets the input control signal threshold where the heat demand is stopped. (Range = 0 to <u>Control Signal to Start Heat Demand</u> )	0.5V
Max Control Signal	42.1.2	Sets the control signal that correlates to the <u>Max Temperature</u> if <u>Control Mode</u> = 0-10V / Temp or max burner power if <u>Control Mode</u> = 0-10V / Power. (Range = <u>Min Control Signal</u> to 10.0V)	9.5V
Min Control Signal	42.1.3	Sets the control signal that correlates to the <u>Min Temperature</u> if <u>Control Mode</u> = 0-10V / Temp or min burner power if <u>Control Mode</u> = 0-10V / Power. (Range = <u>Control Signal to Start Heat Demand</u> to <u>Max Control Signal</u> )	2.0V

16.3.2.6 Restore/Backup

The factory settings are stored in memory in the PCB and can be restored at any time using the “Reset PCB to Factory Defaults Settings” option. After 30 minutes of the boiler first being powered on, the PCB settings are automatically backed up to the display memory for future use (i.e., in the event the PCB is replaced). The operator can at any time select to back up the PCB settings to, or restore the PCB settings from, the display memory, or an external memory (USB Flash Drive) connected to the USB port of the display. See Figure 16-13 and Table 16-12 for details.

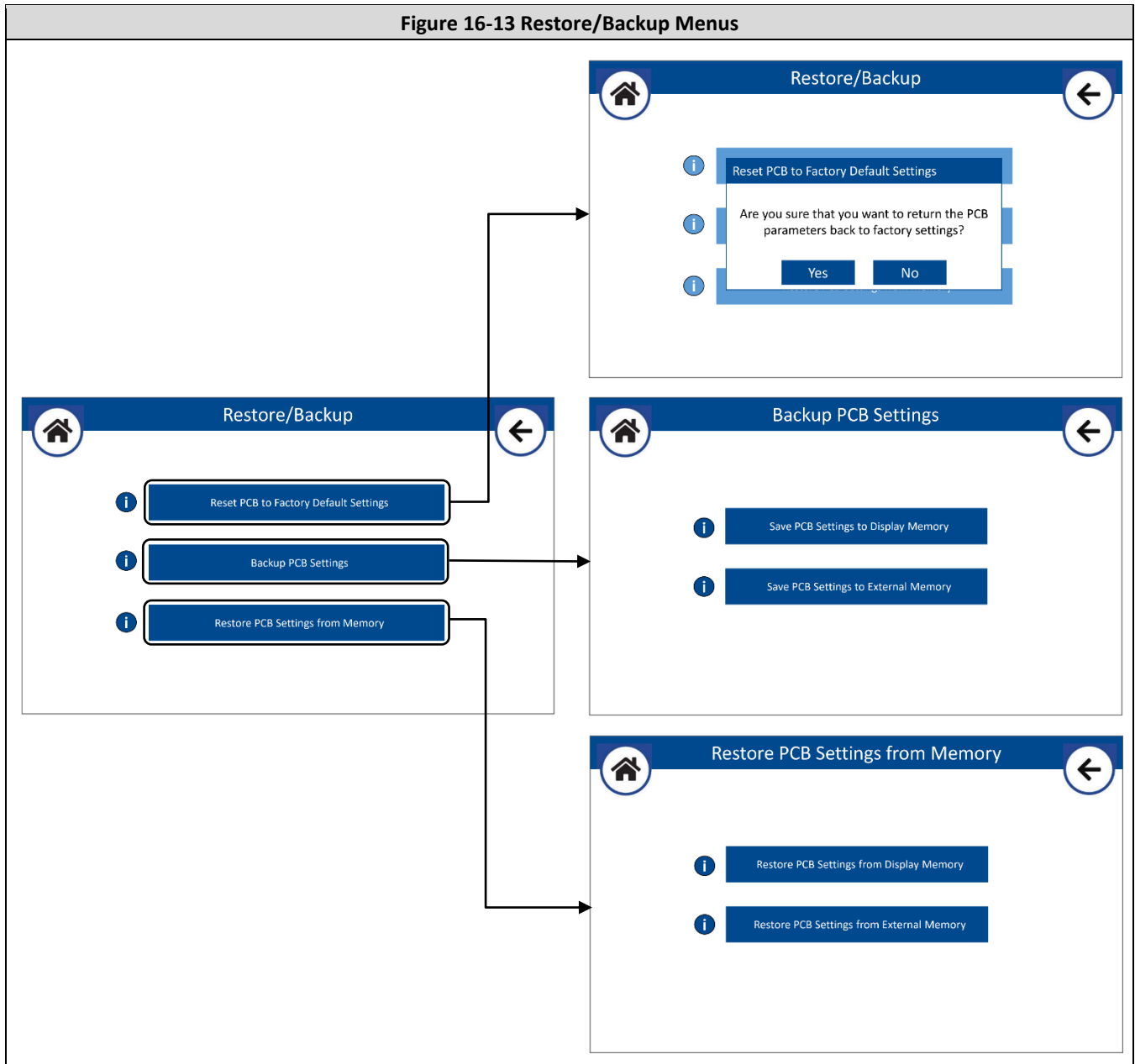


Table 16-12 Restore/Backup

Option	Parameter	Description
Reset PCB to Factory Default Settings	24.19.0	Resets the PCB setting to the values originally set on the PCB at the factory. Note: if it is a replacement PCB the settings will be reset to the default settings of a replacement PCB.

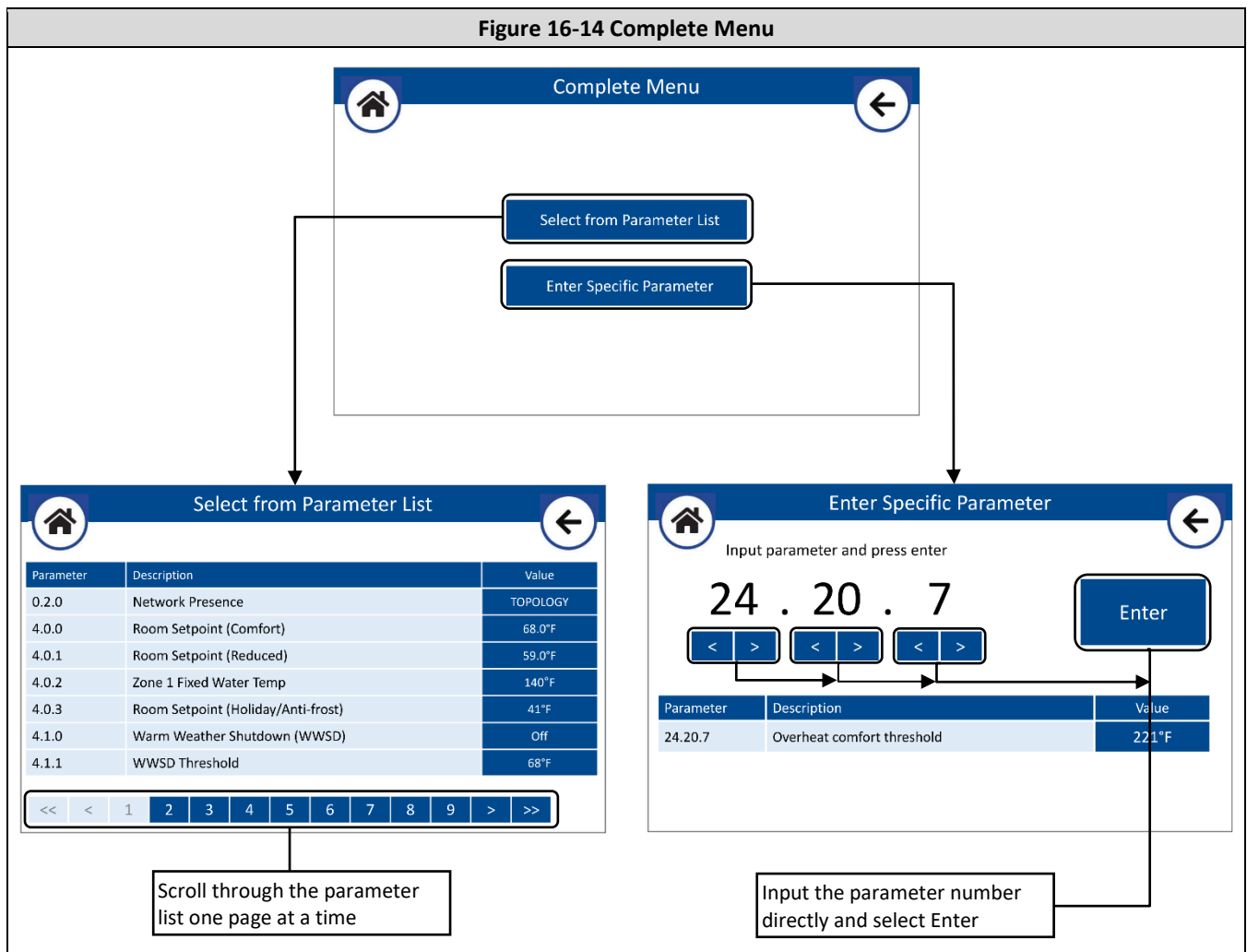
(Continued...)

Table 16-12 Restore/Backup (...Concluded)

Option	Parameter	Description
Backup PCB Settings	NA	Select to back up the PCB settings to the display memory, or to a USB flash drive. <b>Save PCB Settings to Display Memory</b> – select to back up the PCB settings (locally) to the display memory, so they can be restored to the PCB later, i.e., in the event the PCB is replaced. <b>Save PCB Settings to USB</b> – Select to back up the PCB settings to a USB flash drive so they can be restored to the PCB later or to another boiler. <b>NOTE:</b> the process of saving PCB settings to a USB first, copies the PCB settings to the display memory, then transfers those settings to the USB.
Restore PCB Settings from Memory	NA	Select to copy the settings from the display memory or from a USB flash drive to the PCB. <b>Restore PCB Settings from Display Memory</b> – select to copy the settings from the display memory to the PCB. <b>Restore PCB Settings from USB</b> – select to start the process of copying the settings from a USB flash drive to the PCB. <b>NOTE:</b> selecting this feature copies the settings from a USB to the display memory (not to the PCB). When this process is complete it is necessary to transfer the settings from the display memory to the PCB using the <u>Restore PCB Settings from Display Memory</u> feature.

16.3.2.7 Complete Menu

The Complete Menu provides a direct access to all PCB parameters, including some that are not accessible from the other menus, and are generally only accessed by NTI technicians or installers needing to access advanced features. Parameters can be selected by scrolling the complete parameter list, or by entering the specific parameter number directly.



16.3.2.8 Sensor Configuration

The Sensor Configuration menu must be accessed to configure the *AUX1 NTC* and *AUX2 NTC* inputs for use with a System, Buffer Tank, or DHW Recirc sensor; see Figure 16-15 and Table 16-13.

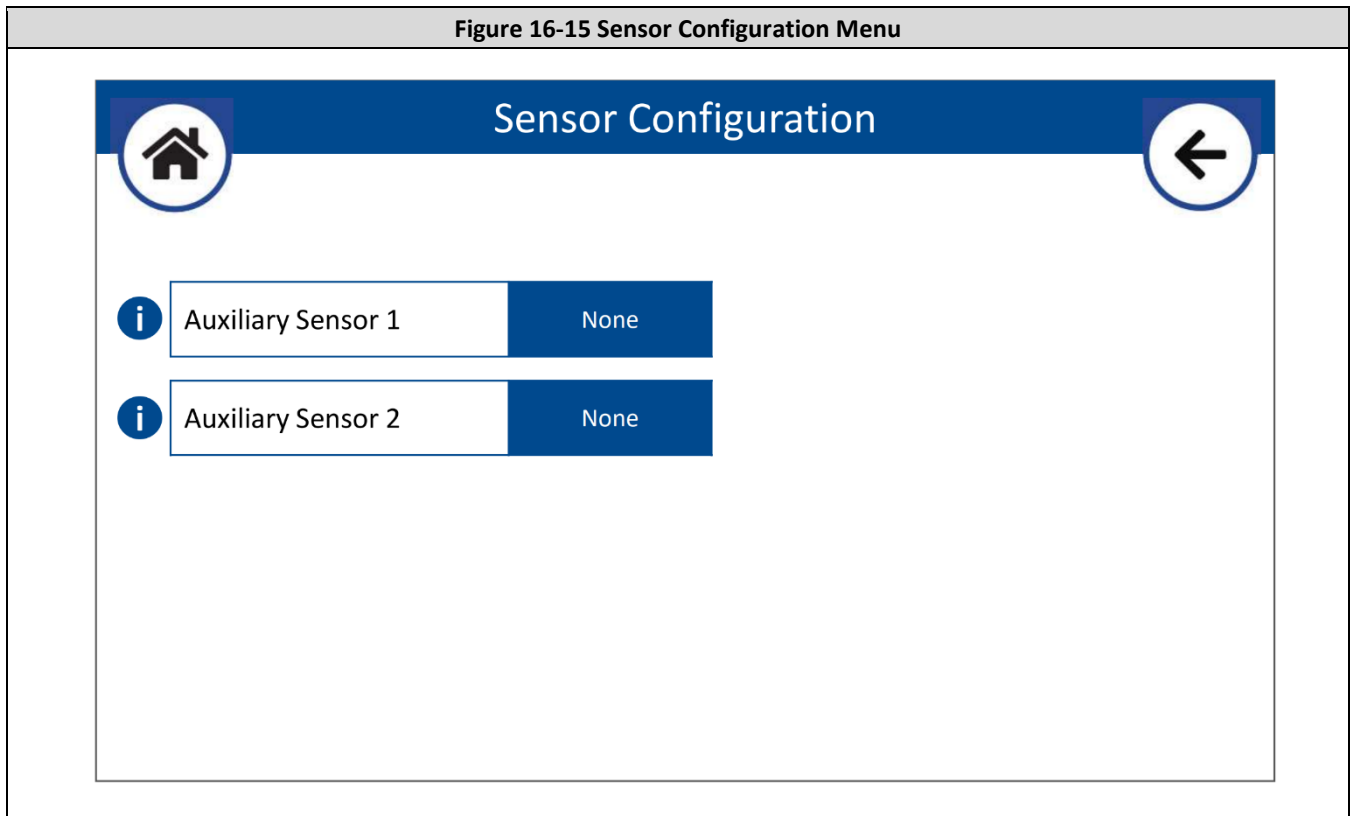


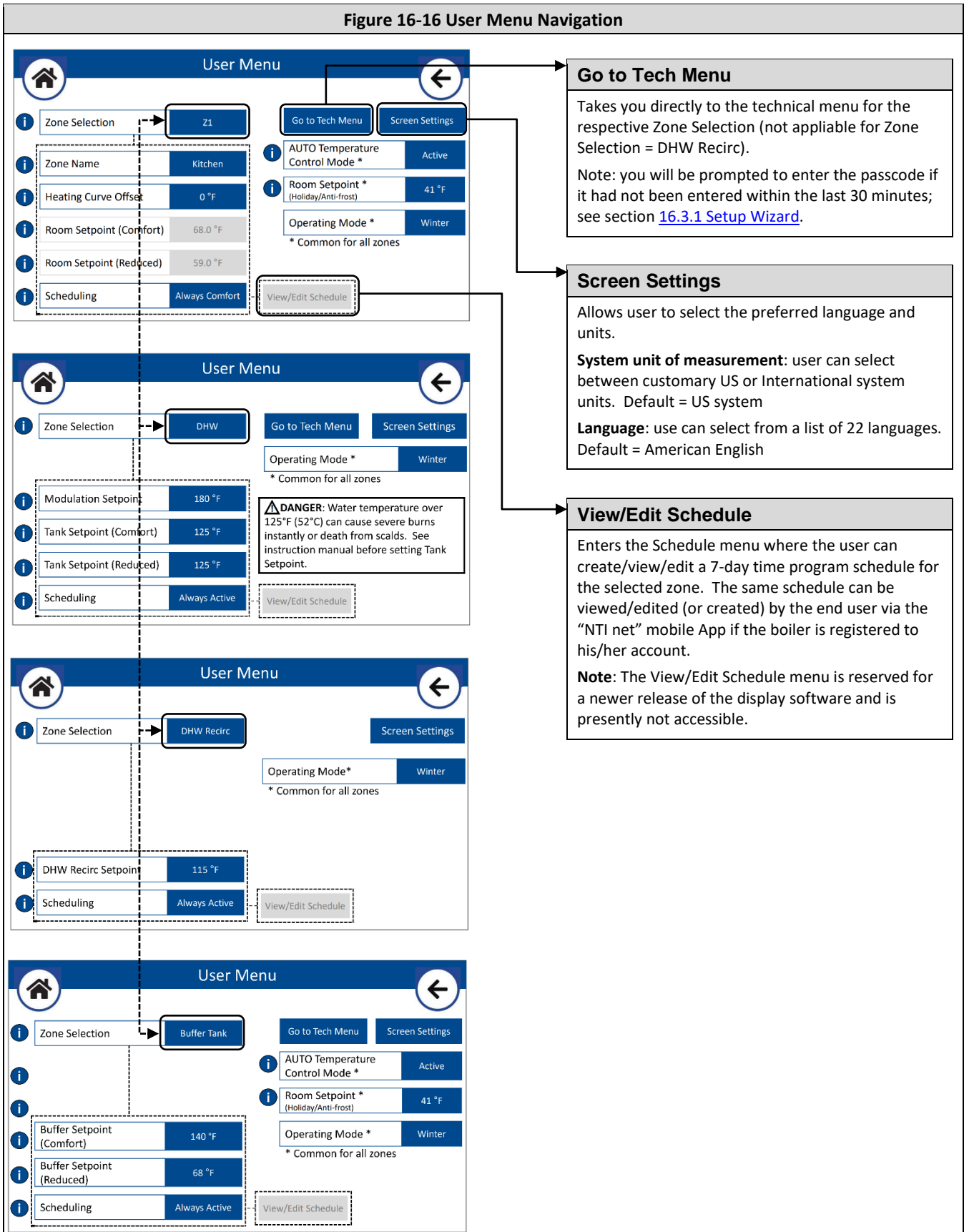
Table 16-13 Sensor Configuration

Setting	Parameter	Range/Description	Factory Setting
Auxiliary Sensor 1	24.6.1	<p>Sets the functionality of input <i>AUX1 NTC</i>.</p> <p><b>None</b> – select if there is no sensor being connected to <i>AUX1 NTC</i></p> <p><b>System Sensor</b> – select if connecting a system temperature sensor to <i>AUX1 NTC</i> for direct boiler control of the system supply temperature.</p> <p><b>Buffer Tank</b> – select if connecting a buffer tank temperature sensor to <i>AUX1 NTC</i> for direct boiler control of the temperature of an external buffer tank.</p> <p>Sensor must be 10k beta = 3977 NTC; an optional strap-on System Sensor is available from NTI (P/N 84010).</p>	None
Auxiliary Sensor 2	24.6.2	<p>Sets the functionality of input <i>AUX2 NTC</i>.</p> <p><b>None</b> – select if there is no sensor being connected to <i>AUX2 NTC</i></p> <p><b>DHW Recirc</b> – select if connecting a DHW recirculation temperature sensor to <i>AUX2 NTC</i> for direct boiler control of a recirculation loop connected to the DHW IWH.</p> <p><b>Buffer Tank</b> – select if connecting a buffer tank temperature sensor to <i>AUX2 NTC</i> for direct boiler control of the temperature of an external buffer tank.</p> <p>Sensor must be 10k beta = 3977 NTC; an optional strap-on System Sensor is available from NTI (P/N 84010).</p>	None

### 16.3.3 User Menu

The User Menu can be accessed without entering the technician passcode and allows for adjustment of user specific settings (i.e., Room Setpoints and Scheduling) and some more advanced settings (i.e., DHW Tank Setpoint and CH Heating Curve Offset/Fixed Water Temp). Use the Zone Selection option to pick the zone settings to be accessed.

Figure 16-16 User Menu Navigation



**Table 16-14 (a) User Menu** (with Zone Selection = Z1)

Setting	Parameter*	Range/Description	Factory Setting
Zone Selection	NA	Allows selection of the zone that you would like to view/modify; options are Z1, Z2, Z3, DHW, DHW Recirc & Buffer Tank. <b>Note:</b> options extend to Z4, Z5 & Z6 if using an NTI N-Link ZC3 zone controller, or for cascade application.	Z1
Zone Name	NA	Allows the user to select a unique name for each central heating (CH) zone.	Zone #
Heating Curve Offset <i>(if AUTO = Active)</i>	4.2.3	Provides a means to offset (+/-) the calculated reset boiler target temperature up or down. (Range = -25-25) <b>Note:</b> the setting has no impact if <u>Auto Slope Boost</u> = On. <b>Note:</b> settings changes to <u>Zone 1 Fixed Water Temp</u> if <u>AUTO Temperature Control Mode</u> = Active	0
Zone # Fixed Water Temp <i>(if AUTO = Not Active)</i>	4.0.2	Boiler target setpoint for CH zone 1 demand. (Range = 4.2.6-4.2.5). <b>Note:</b> settings changes to <u>Heating Curve Offset</u> if <u>AUTO Temperature Control Mode</u> = Not Active	4.2.5
Room Setpoint (Comfort)	4.0.0	Room temperature setpoint for selected zone during Comfort time period. Only applicable when using an NTI Room Sensor. (Range = 50-86°F)	68°F
Room Setpoint (Reduced)	4.0.1	Room temperature setpoint for CH zone 1 during Reduced time period. Only applicable when using an NTI Room Sensor. (Range = 50-86°F)	59°F
Scheduling	4.0.4	Allows the user to select the type of schedule for the selected zone/demand. For heating zones, only applicable when using an NTI Room Sensor: <b>Always Off</b> – disabled...boiler ignores demand. <b>Always Comfort</b> – temperature is always maintained at the Comfort setpoint. <b>Always Reduced</b> – temperature is always maintained at the Reduced setpoint. <b>Time Program</b> – temperature setpoint toggles between the Comfort and Reduced setpoints according to the defined time program (see View/Edit Schedule)	Always Comfort
AUTO Temperature Control Mode	24.4.0	Allows the user to globally enable/disable the Automatic Temperature Control Mode.	Active
Room Setpoint (Holiday/Anti-frost)	4.0.3	Sets the global room temperature setpoint during holiday or inactive periods. Only applicable when using an NTI Room Sensor. (Range = 35-75°F)	41°F
Operating Mode	NA	See section <a href="#">16.2 Operating Mode</a>	Winter

\* Parameter numbers starting with 4 are for Zone 1; substitute the 4 with a 5 (for Zone 2); 6 (for Zone 3); 14 (for Zone 4); 15 (for Zone 5) or 16 (for Zone 6) for equivalent respect zone parameter.

**Table 16-14 (b) User Menu** (with Zone Selection = DHW)

Setting	Parameter	Range/Description	Factory Setting
Zone Selection	NA	Allows selection of the zone that you would like to view/modify; options are Z1, Z2, Z3, DHW, DHW Recirc & Buffer Tank. <b>Note:</b> options extend to Z4, Z5 & Z6 if using an NTI N-Link ZC3 zone controller, or for cascade application.	DHW
Modulation Setpoint	24.20.0	Boiler outlet water temperature target during DHW demands. (Range = 68-190°F)	180°F
Tank Setpoint (Comfort)	24.5.0	See Table 16-6	125°F
Tank Setpoint (Reduced)	24.20.9	Establishes the target temperature of the DHW tank (IWH) during Reduced time period. Setting is only applicable when DHW Mode is set to Tank Sensor. (Range = 50-190°F)	125°F
Scheduling	24.5.1	Allows the user to select the type of schedule for heating the DHW tank. <b>Disabled</b> – boiler ignores DHW tank demands. <b>Time Program</b> – tank temperature setpoint toggles between the Comfort and Reduced setpoints according to the defined time program (see View/Edit Schedule). Only applicable when a tank sensor is utilized. <b>Always Active</b> – tank temperature is always maintained at the Comfort setpoint (if tank sensor is used), or at aquastat setpoint if aquastat is used.	Always Active
Operating Mode (Scheduling*)	NA	See section <a href="#">16.2 Operating Mode</a>	Winter

**Table 16-14 (c) User Menu** (with Zone Selection = DHW Recirc)

Setting	Parameter	Range/Description	Factory Setting
Zone Selection	NA	Allows selection of the zone that you would like to view/modify; options are Z1, Z2, Z3, DHW, DHW Recirc & Buffer Tank. <b>Note:</b> options extend to Z4, Z5 & Z6 if using an NTI N-Link ZC3 zone controller, or for cascade application.	DHW Recirc
DHW Recirc Setpoint	24.20.6	Establishes the target temperature of the DHW recirculation loop. (Range = 32-190°F)	115°F
Scheduling	24.5.7 & 24.5.8	Allows the user to select the type of schedule for heating the DHW Recirculation loop. <b>Always Active</b> – DHW Recirc temperature is always maintained at the DHW Recirc setpoint <b>Time Program</b> – DHW Recirc temperature is maintained at the DHW Recirc setpoint while the DHW is in Comfort mode <b>DHW Recirc Time Program</b> – DHW Recirc temperature is maintained at the DHW Recirc setpoint according to the defined time program (see View/Edit Schedule). Note: If a DHW Recirc sensor is used, then the DHW Recirc pump turns off when the DHW Recirc setpoint is attained - otherwise the DHW Recirc pump remains on.	Always Active
Operating Mode (Scheduling*)	NA	See section <a href="#">16.2 Operating Mode</a>	Winter

**Table 16-14 (d) User Menu** (with Buffer Tank selected)

Setting	Parameter*	Range/Description	Factory Setting
Zone Selection	NA	Allows selection of the zone that you would like to view/modify; options are Z1, Z2, Z3, DHW, DHW Recirc & Buffer Tank. <b>Note:</b> options extend to Z4, Z5 & Z6 if using an NTI N-Link ZC3 zone controller, or for cascade application.	Buffer Tank
Buffer Setpoint (Comfort)	20.0.3	Buffer tank setpoint during Comfort time period. (Range = 50-190°F)	120°F
Buffer Setpoint (Reduced)	20.3.1	Buffer tank setpoint during Reduced time period. (Range = 50-190°F)	68°F
Scheduling (Control Mode)	20.3.0	Allows the user to select the type of schedule for heating the buffer tank. Only applicable when <u>Buffer Tank Function</u> is set as Fixed Temperature. <b>Always Off</b> – disabled...boiler ignores buffer tank demands. <b>Time Program</b> – buffer tank temperature setpoint toggles between the Comfort and Reduced setpoints according to the defined time program (see View/Edit Schedule). <b>Always Active</b> – Buffer tank temperature is always maintained at the Comfort setpoint.	Always Active
AUTO Temperature Control Mode	24.4.0	Allows the user to globally enable/disable the Automatic Temperature Control Mode.	Active
Room Setpoint (Holiday/Anti-frost)	4.0.3	Sets the global room temperature setpoint during holiday or inactive periods. Only applicable when using an NTI Room Sensor. (Range = 35-75°F)	41°F
Operating Mode (Scheduling*)	NA	See section <a href="#">16.2 Operating Mode</a>	Winter

\* Parameter numbers starting with 4 are for Zone 1; substitute the 4 with a 5 (for Zone 2); 6 (for Zone 3); 14 (for Zone 4); 15 (for Zone 5) or 16 (for Zone 6) for equivalent respect zone parameter.



### 16.3.4 Test Mode

The Test Mode is a technical menu and therefore requires the user to enter the passcode “ntinet” if it had not been entered within the last 30 minutes; see section [16.3.1 Setup Wizard](#) for details.

Figure 16-17 Test Mode Menu

Test Mode
←

Burner Test

Output Test

Air Purge Function

**Burner Test**

Select the burner power to be tested. If Manual Power is selected the operator can manually adjust the power level from the bottom-right of the screen. To stop the test, select “Press to Stop Test”. See section [9.0 GAS VALVE AND BURNER SET-UP](#) for details.

**Note:** initiating burner test automatically turns on the Boiler, System and Zone pumps – there is no need to turn on a heating demand.

**Note:** the burner test is automatically cancelled if there is a blocking error, the Outlet temperature exceeds 185°F, if the Burner Test screen is exited, or after running for 30 minutes

**Output Test**

Allows for manual operation of each of the boiler’s on/off outputs. Set Manual Mode Activation to On before switching the respective outputs On.

**Note:** the burner is automatically switched off when the output test is started.

**Note:** the output test will run for 60 minutes or until Manual Mode Activation is switched off – even if the screen is exited.

**Air Purge Function**

Selecting causes the controller to perform the air purge sequence that is designed to purge air from the boiler water. The air purge sequence cycles the circulators off and on, for a period of 6 minutes (12 minutes for cascade systems), to help free air pockets that may exists in the heat exchanger and boiler piping. Press Cancel to stop the sequence and return to normal operation.

**Note:** burner operation is canceled for the duration of the air purged sequence.

Burner Test
←

Burner Test Not Initiated

71°F

Outlet

Burner State:  
Standby

0%

0 MBH 0 RPM

Burner Power

Press to Stop Test

Manual Power  
Press to Start Test

Max Power  
Press to Start Test

Min Power  
Press to Start Test

Power Level

10%

Output Test
←

\* Set Manual Mode Activation to On before switching outputs

Manual Mode Activation*	Off	Zone 1 Output	Off
Boiler Pump	Off	Zone 2 Output	Off
DHW Pump	Off	Zone 3 Output	Off
Auxiliary Pump 1	Off	Zone 4 Output	Off
Fan	Off	Zone 5 Output	Off
Auxiliary Pump 2	Off	Zone 6 Output	Off
Flue Damper	Off	Alarm	Off

199 MBH Manager
41°F
⏻

Dec 18 2020 - 11:20pm

141°F

Inlet

18 PSI

Press

126°F

DHW

142°F

Outlet

Burner State:  
Inhibited

Demand:  
Air purge active

Cancel

0%

0MBH 0RPM

Burner Power

Boiler Pump

System Pump

DHW Recirc

1. Kitchen

2. Living Room

3. Bedroom

4. Entrance

5. Bedroom 2

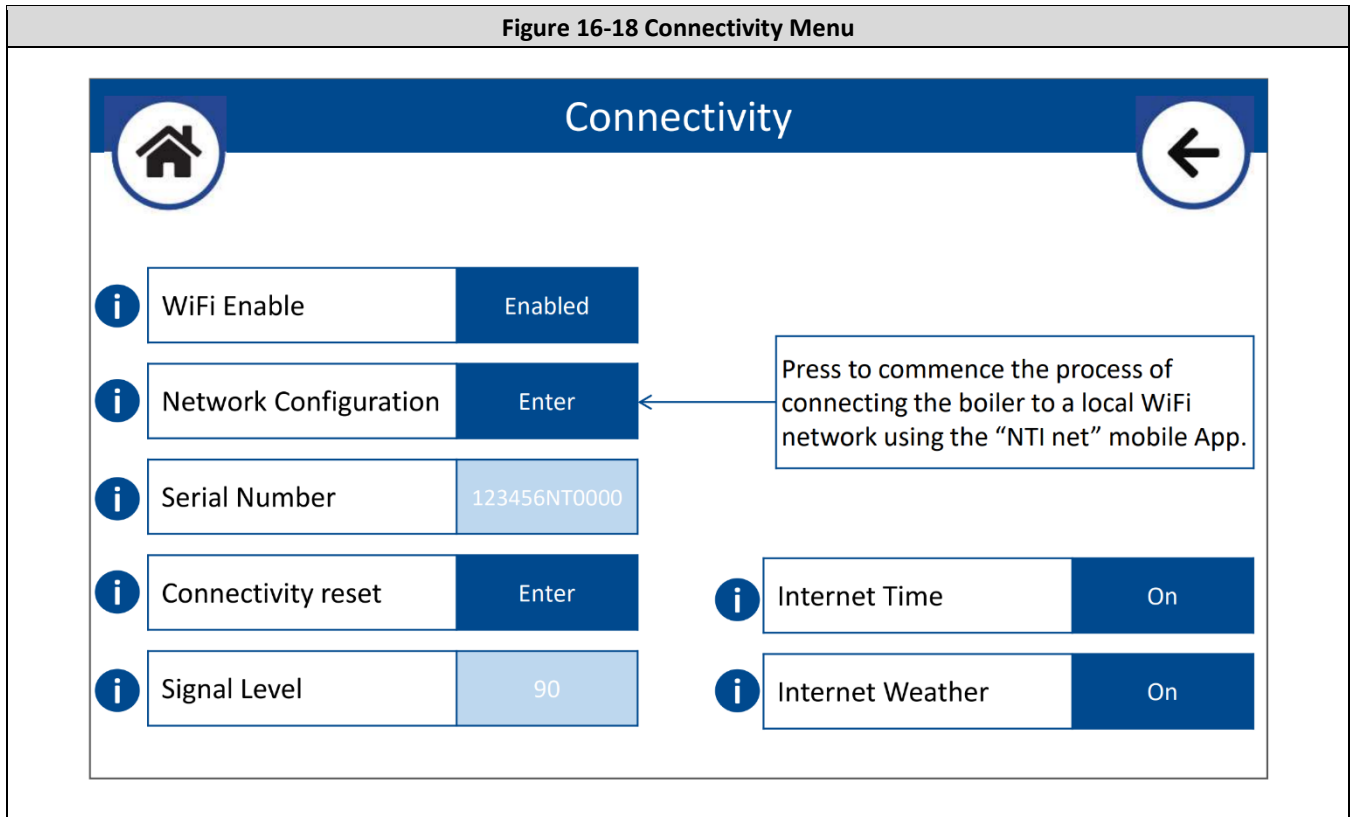
6. Bedroom 3

DHW Setpoint 125°F

Setup
Zone Details
Boiler Details
Cascade
Errors

### 16.3.5 Connectivity

The Connectivity menu will need to be accessed to connect the boiler to WiFi unless you opted to “...connect your product to the internet...” from the [Setup Wizard](#). See section [17.0 WIFI CONNECTION](#) for detailed instructions for connecting the boiler to WiFi.



**Table 16-15 Connectivity**

Setting	Parameter	Range/Description	Factory Setting
WiFi Enable	19.0.0	<b>On</b> – connection to WiFi is possible <b>Off</b> – disconnects boiler from WiFi	On
Network Configuration	NA	Select <b>Enter</b> to commence the process of connecting the boiler to a local WiFi network using the “NTI net” mobile App	NA
Serial Number	19.1.3	Serial number of the boiler's WiFi gateway. Serial number is required when registering the boiler on the “NTI net” connectivity platform.	NA
Connectivity reset	19.2.0	Select if you need to reconfigure the WiFi connection, i.e., if you need to select a different WiFi network. To re-establish WiFi connection, enter the Network Configuration.	NA
Signal Level	19.1.1	Displays the WiFi router signal strength.	NA
Internet Time	19.0.3	Set to "On" to have the time automatically set via the internet connection based on the boiler's entered address. Note: the address is entered when registering the boiler to an “NTI net” End User or Service Center.	Off
Internet Weather	19.0.4	Set to "On" to have the outdoor temperature reading acquired via the internet connection based on the boiler's entered address. Note: the address is entered when registering the boiler to an “NTI net” End User or Service Center.	Off

### 16.3.6 Diagnostics

The Diagnostics menu provides access to the Maintenance Warning feature ([Service](#)), boiler operating statistics ([Statistics](#)), display and PCB software versions ([Version](#)), and a list of the open-source licenses used by the display ([Software License](#)).

**Figure 16-19 Diagnostics Menu**

**Diagnostics**

Service

Version

Statistics

Software License

**Service**

- i Months to Next Maintenance 12
- i Enable Maintenance Warning Off
- i Maintenance Warning Reset RESET

**Statistics**

Boiler power on time (h/10)	17520	CH/DHW priority switches	2
Total burner on time (h/10)	4012	Boiler pump cycles (n/10)	1675
CH burner on time (h/10)	2967	DHW pump cycles (n/10)	410
DHW burner on time (h/10)	1045	Fan cycles (n/10)	2104
Fan on time (h/10)	4589	Ignition cycles (n/10)	1974
Boiler pump on time (h/10)	6756	Flame faults (n/10)	1
Average CH cycle time (min)	12		

**Version**

Display (HMI)

Version	6023-2000-6316
Hardware Version	6023-2000-1003
Serial Number	21-26-001-090

Controller (main PCB)

Version	00.19.06
---------	----------

**Software License**

Provides the open-source licenses of the software components used within the display.

**Service**

**Months to Next Maintenance** (parameter 24.17.0): Sets the number of months until a Maintenance Warning is triggered; number counts down over time. Only applicable when Enable Maintenance Warning is set to On. Default = 12 months; Range = 0-24 months.

**Enable Maintenance Warning** (parameter 24.17.1): When set to On, a Maintenance Warning will occur at a frequency set by Months to Next Maintenance. Default = Off.

**Maintenance Warning Reset** (parameter 24.17.2): Press to reset the Months to Next Maintenance counter, i.e., after completing the scheduled maintenance of the appliance.

**Statistics**

List of all available boiler statistics stored on the main PCB. Values are read only.

Note: if the main PCB is replaced the values will be reset, i.e., revert to the statistics of the replacement PCB.

**Version**

**Display (HMI)**: lists the software and hardware version, and serial number of the display.

**Controller (main PCB)**: lists the software version of the PCB.

Note: the display software can be updated by inserting a USB flash drive, containing the new software, into the USB port of the display.

16.4 Zone Details

Figure 16-20 Zone Details Screen

**Central Heating:**

Lists the details and status of each of the CH zones. Note: Zone # 4-6 correspond to zones 1-3 of a second zone controller (applicable for cascade system or with N-link 3ZC).

**Room Temp** – current room temperature (only applicable for zones using NTI Room Sensor)

**Active** – status of the zone input; turns green when the zone is calling, and the Priority Level is current

**Boiler Target** – calculated (Current) boiler target temperature and possible range (Min/Max) dictated by the given zone. Adjustable via the [CH Setup](#) menu

**Output** – status of the zone output; turns green when the output is switched on

**AUTO Temp Contrl Mode** – adjustable via [CH Setup](#)

**Priority Level** – adjustable via [CH Setup](#) -> Advanced Settings

Zone Details									
Central Heating:									
Zone #	Name	Room Temp	Active	Boiler Target			AUTO Temp Contrl Mode	Output	Priority Level
				Current	Min	Max			
1	Kitchen	--	<span style="color: green;">●</span>	159°F	100°F	180°F	Outdoor Temp	<span style="color: green;">▶</span>	1
2	Living Room	--	<span style="color: green;">●</span>	132°F	90°F	160°F	Outdoor Temp	<span style="color: green;">▶</span>	1
3	Bedroom	65°F	<span style="color: grey;">○</span>	--	80°F	120°F	Room&Outdoor	<span style="color: grey;">▶</span>	2
4	Entrance	72°F	<span style="color: grey;">○</span>	--	90°F	160°F	Basic On/Off	<span style="color: grey;">▶</span>	1
5	Bedroom 2	65°F	<span style="color: grey;">○</span>	--	80°F	120°F	Room Temp	<span style="color: grey;">▶</span>	2
6	Bedroom 3	58°F	<span style="color: grey;">○</span>	--	80°F	120°F	Fixed Outlet	<span style="color: grey;">▶</span>	2

DHW:					
Demand	Setpoint	Temperature	Active	Boiler Target	Output
Tank Sensor – Downstream IWH	125°F	126°F	<span style="color: grey;">○</span>	--	<span style="color: grey;">▶</span>
Recirc	115°F	121°F	<span style="color: grey;">○</span>	--	<span style="color: grey;">▶</span>

**DHW:**

Lists the details and status of the DHW Demands, IWH (Tank Sensor or Aquastat / Downstream or Upstream) and Recirc.

**Setpoint** – adjustable via [DHW Setup](#) and [User Menu](#)

**Temperature** – current temperature readings from *DHW SWITCH/NTC* and *AUX2 NTC*

**Active** – status of the demand; turns green when calling

**Boiler Target** – boiler target temperature dictated by the given zone. Adjustable via [DHW Setup](#) -> Advanced Settings option Modulation Setpoint. Not applicable for DHW Recirc.

**Output** – status of the DHW and DHW Recirc pumps.

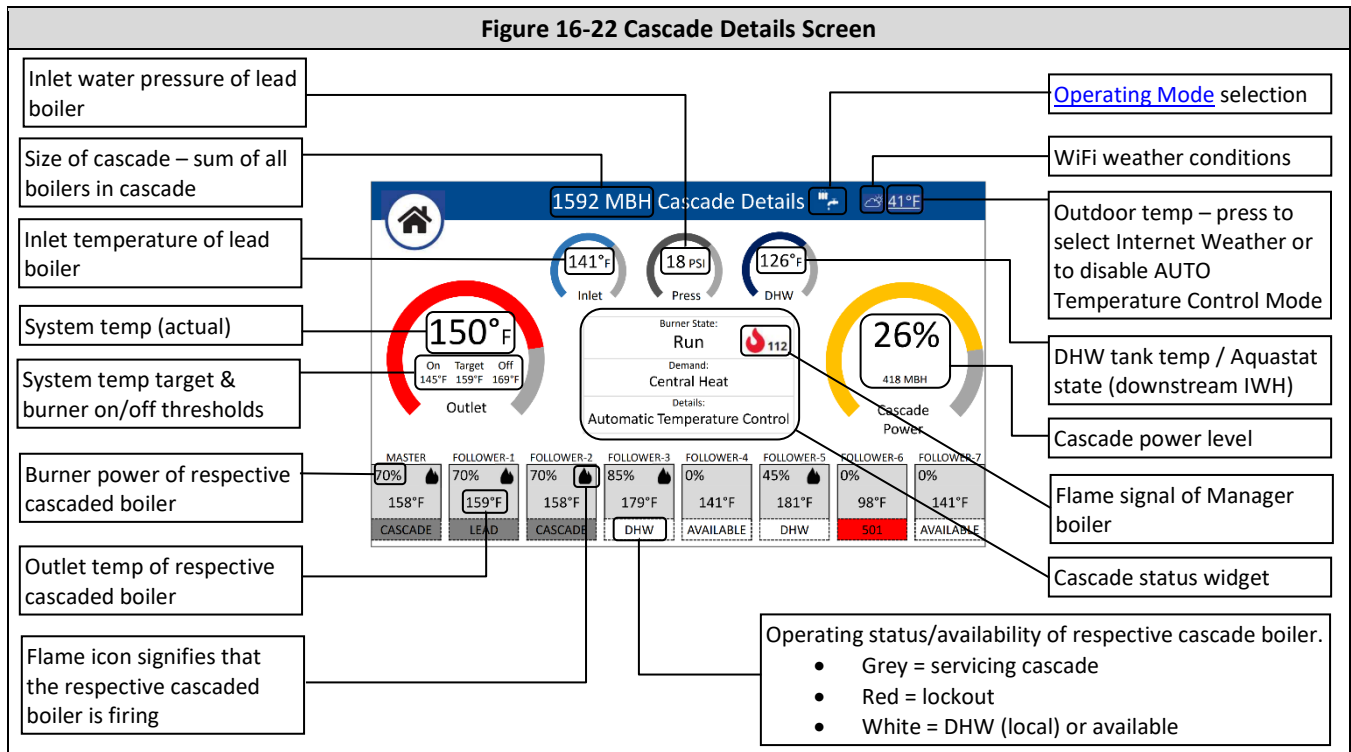
16.5 Boiler Details

Figure 16-21 Boiler Details Screen

The screenshot shows the 'Boiler Details' screen with the following data and callouts:

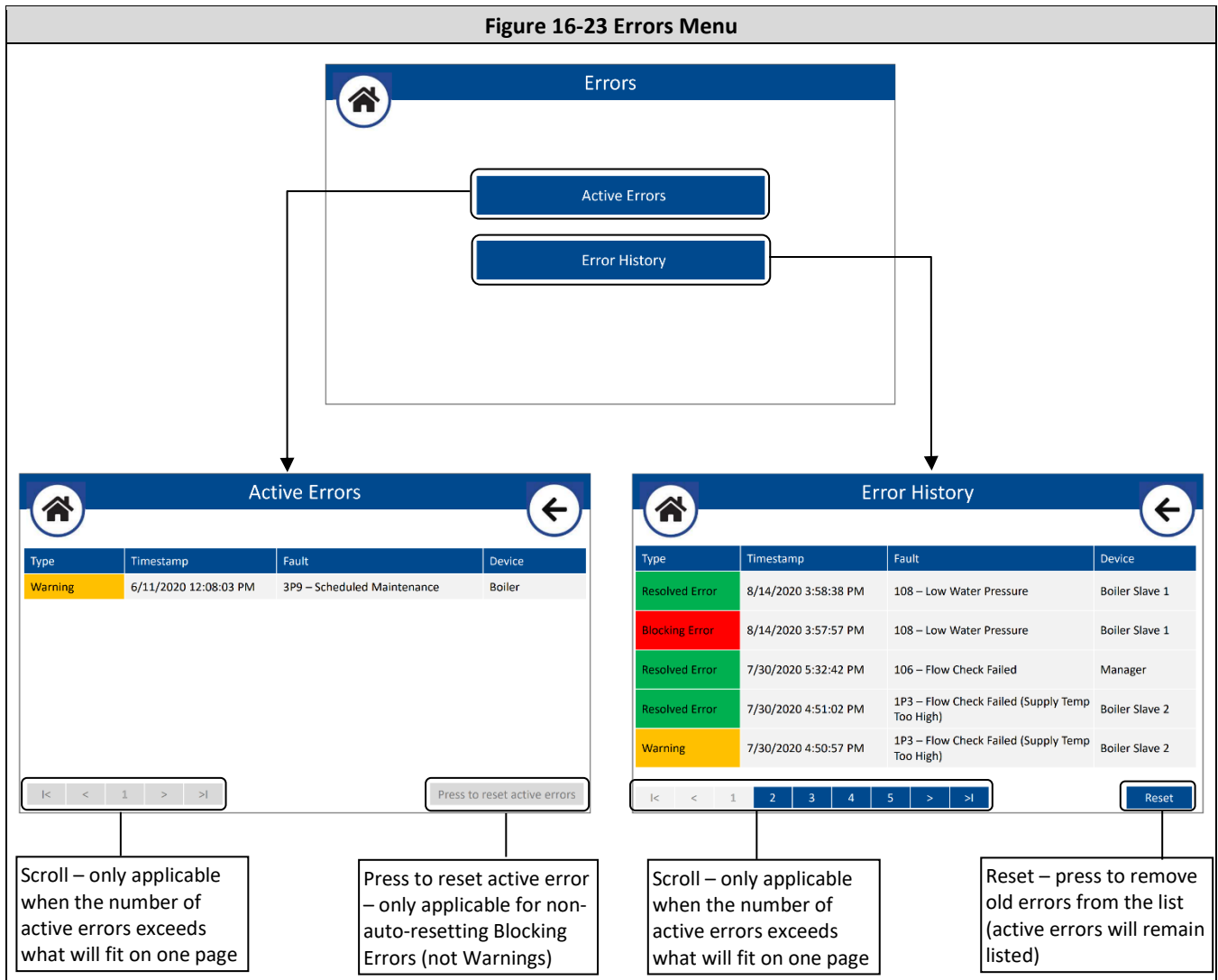
- Target** – current modulation setpoint temperature for the boiler (159°F)
- System** – only visible when a sensor is connected to *AUX1 NTC* and Auxiliary Sensor 1 is set to System Sensor (150°F)
- Outlet 1,2** – readings from the boiler's duplex outlet sensor (Outlet 1: 158°F, Outlet 2: 157°F)
- BMS** – only applicable when BMS Control Mode is set to 0-10V (Power/Temp) (BMS Signal: 0.1, BMS Status: 1)
- Inputs** – gives the status of each of the boiler's on/off inputs (Cond. Sw., Ext. Limit, Flue Damper, Gas Press Sw., LWCO, Zone 1-6)
- Outputs** – gives the status of each of the boiler's on/off outputs, green means on (Boiler Pump, DHW Recirc, DHW Pump, System Pump, Zone 1-6, Alarm, Flue Damper)

### 16.6 Cascade



### 16.7 Errors

Active errors and error history are listed on the respective menu option screen selectable from the Errors menu. Each screen lists the type of error (Warning or Blocking Error), timestamp when each occurred, fault description, and device (Boiler, Manager, Boiler Slave 1,2...7) the error occurred on



## 17.0 WIFI CONNECTION

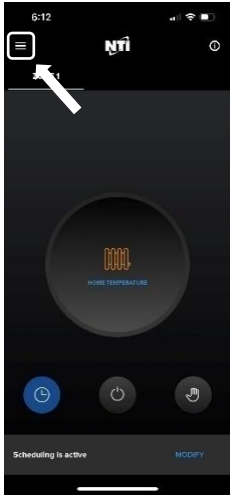
Before proceeding, download the “NTI net” mobile app to your smartphone and login with your “NTI net” credentials. The app guides you through the process of connecting the boiler to the local WiFi Network and registering it to your “NTI net” (nti.remotethermo.com) account. If you do not have an “NTI net” account, visit nti boilers.com and select the “NTI net” icon to register.

The function of the “NTI net” mobile app depends on the type of user; homeowners can manage connected appliance via the app (including setting and modifying heating schedules), while contactors can only use the app to connect and register appliances. As a result, the landing page when the app is opened will look different for homeowners and contractors:

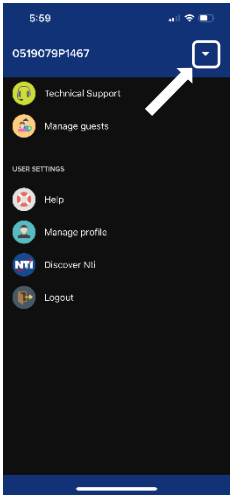
- **Homeowners** – if you have logged into the app with a homeowner account, you will first need to navigate to the “Add product” page to begin the connection process; see Figure 17-1.
- **Contractors** – if logged into the app with a contractor account, the app will open on the “Add product” page; see Figure 17-2.

**Figure 17-1 “NTI net” App – Navigating to the “Add Product Page” (Homeowner account only)**

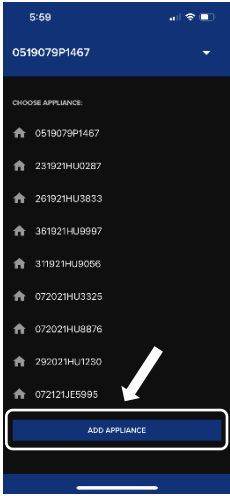
**1** Select the menu button in the top left of the screen




**2** Select the dropdown button to expose the ADD APPLIANCE button



**3** Select **ADD APPLIANCE**

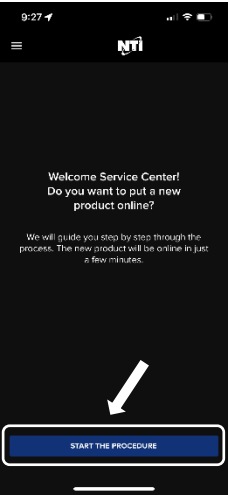


**4** Select **ADD** to proceed to the “Add product” page; see Figure 17-2

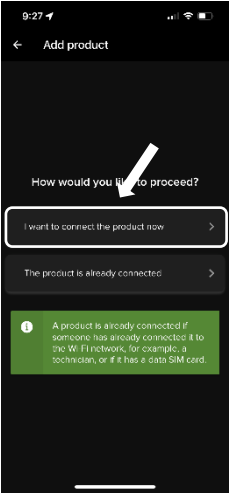


**Figure 17-2 “NTI net” App – “Add Product Page”**

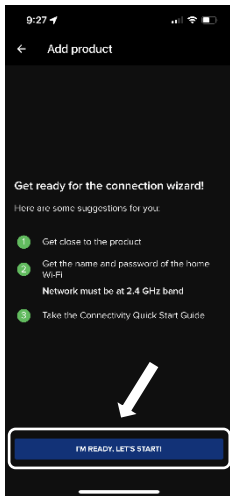
**1** Open the “NTI net” mobile app and press **START THE PROCEDURE**



**2** Select **I want to connect the product now**



**3** When ready, select **I'M READY, LET'S START!** to proceed



**4** Select **I HAVE STARTED THE PROCEDURE** then move to the boiler display to start the connection procedure on the boiler; see Figure 17-3. If using the [Setup Wizard](#), start at step 4

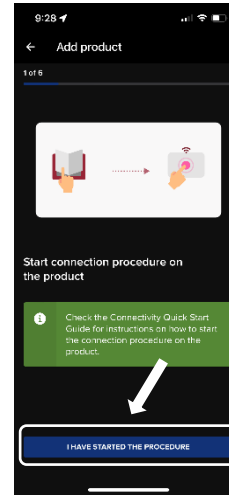


Figure 17-3 Starting the Connection Procedure at the Boiler

**1** Select **Setup** from the home screen

**2** Select **Connectivity** from the Setup menu

**3** Press Enter to start the **Network Configuration**

**4** Select **Yes** to connect the boiler to the internet.

**5** When this popup appears, the “NTI net” app will prompt you to Join “Remote Gw Thermo”; see Figure 17-4

**6** Upon confirming a WiFi network (Figure 17-4 step 4), the display shows the progress of the connection

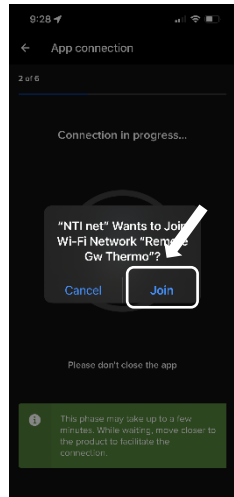
**7** The boiler will advise when the connection to the local WiFi network is complete. Press **OK** to proceed.

**8** Choose **Yes** or **No** to using Internet Time and Weather. The boiler is not connected to the local WiFi Network.

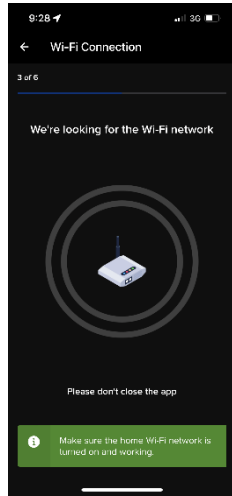


Figure 17-4 “NTI net” App – Making WiFi Connection and Registering Product

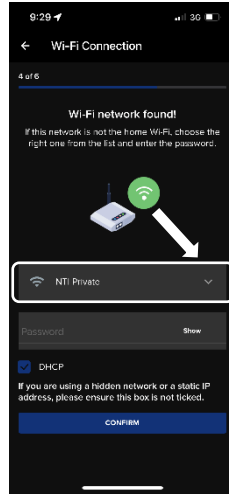
1 Press **Join** to connect to the boiler



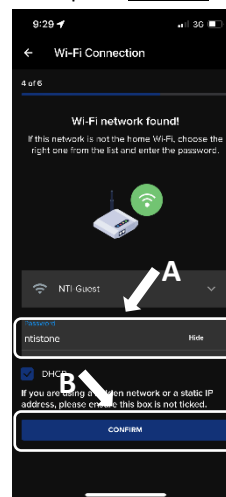
2 Wait while the app searches for available WiFi networks



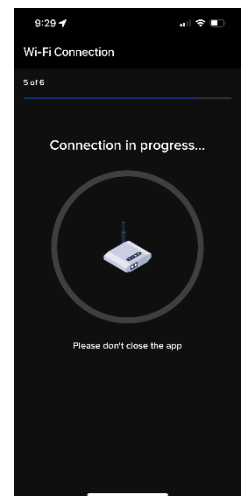
3 Select the WiFi Network from the dropdown menu



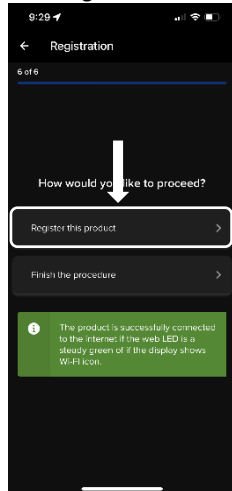
4 Enter the password and press **Confirm**



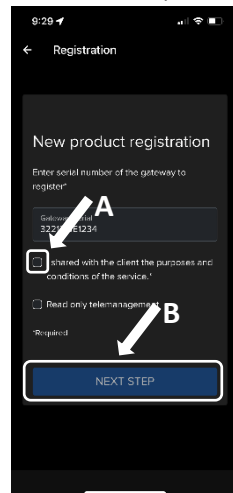
5 Wait while the connection to the WiFi Network is made



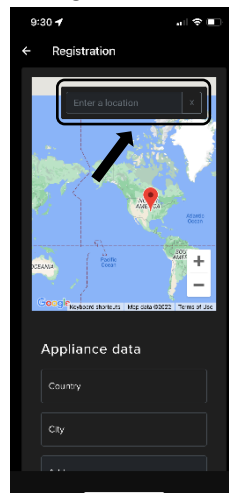
6 Boiler is successfully connected to Wifi, to register it to your “NTI net” account select **Register the product**; otherwise close the App and finish the setup at the boiler; see Figure 17-3



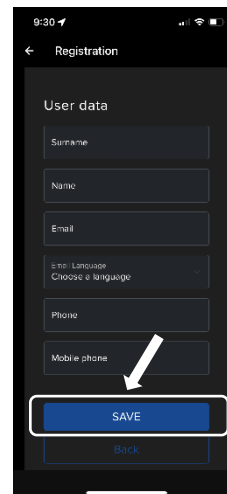
7 Check the box next to **I shared with the client the purposes and conditions of the service**, then press **NEXT STEP** to proceed



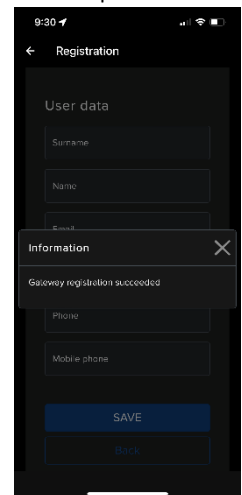
8 Start typing the address in the box above the map – select the correct address from the autogenerated list.



9 Scroll down the page and enter the User data (optional), then select **SAVE**



10 Boiler is now registered to your “NTI net” account and can be remotely monitored and adjusted. Proceed to finish the setup at the boiler; see Figure 17-3 steps 7 & 8



## 18.0 TROUBLESHOOTING



Observe the following precautions when servicing the boiler. Failure to comply with these may result in fire, property damage, serious injury or death.

### Before Servicing the Boiler

- Disconnect or shutoff all energy sources to the boiler: 120VAC power, water, and gas.
- Identify and mark wires before disconnecting or removing them.
- Never bypass electrical fuses or limit devices except temporarily for testing.
- Use proper personal protective equipment (PPE) i.e., eye protection, safety footwear.

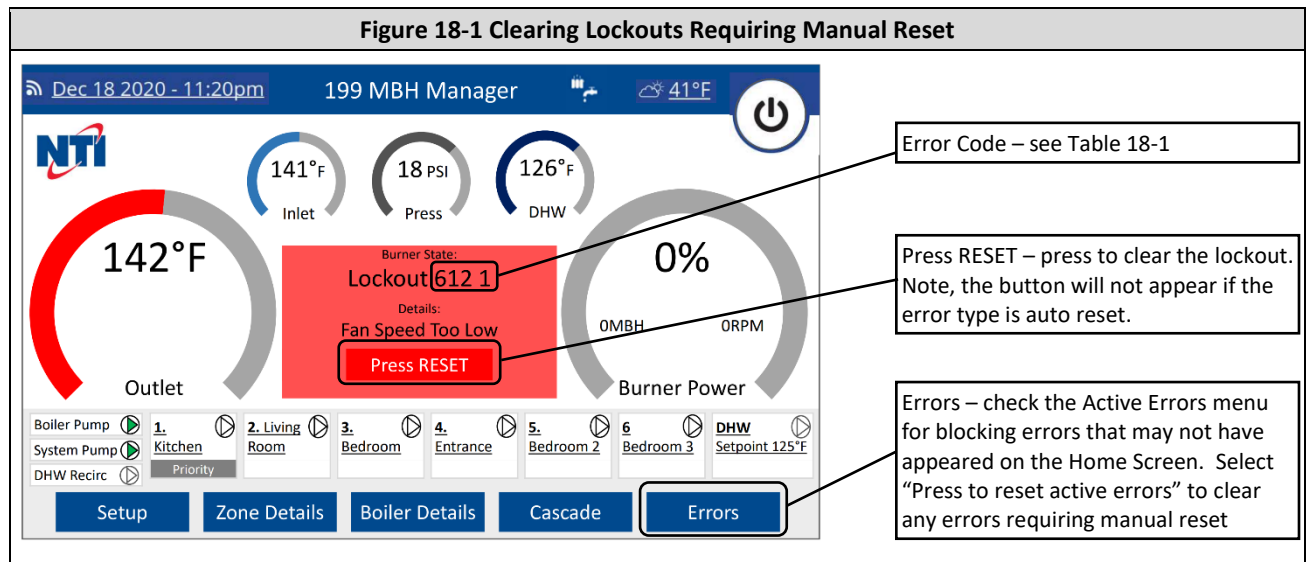
### Diagnostic Procedures

These procedures should only be performed by qualified service personnel when abnormal operation of the boiler is suspected. The boiler incorporates a sophisticated microprocessor-based control which normally responds appropriately to varying conditions. If the boiler operation appears to be incorrect, follow these procedures to identify, and correct, the source of the problem.

1. **Blocking Error** – read the error code displayed on the Home Screen and follow the suggestions listed in Table 18-1. If an error is not displayed on the Home Screen check for errors listed on the Active Errors screen of the [Errors](#) menu. If there are no errors listed on the Active Errors screen, then proceed to the next step.

**NOTE:** for errors that require a manual reset, a “Press RESET” button will be located beneath the error description – press to clear the lockout; see Figure 18-1. Alternatively, errors requiring manual reset can be cleared from the [Active Errors](#) screen by selecting “Press to reset active errors”; see section [16.7 – Errors](#).

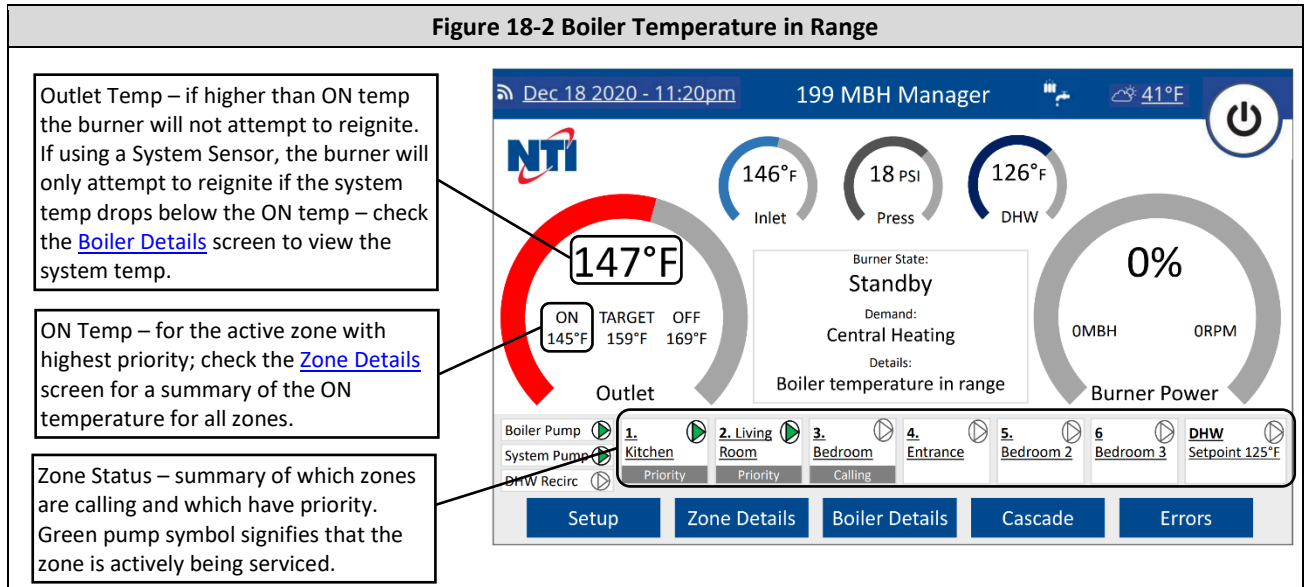
**NOTE:** errors that are auto reset will clear automatically when the error condition is resolved; for these errors, the “Press RESET” button will not appear.



2. **Boiler Temperature in Range** – the burner will only turn on if the boiler outlet temperature (or system temperature – if using a system sensor) is below the ON temperature threshold of the heat demand being serviced. Compare the ON temperature to the outlet (or system) temperature, if the ON temperature is lower, then the burner will not fire; see Figure 18-2.

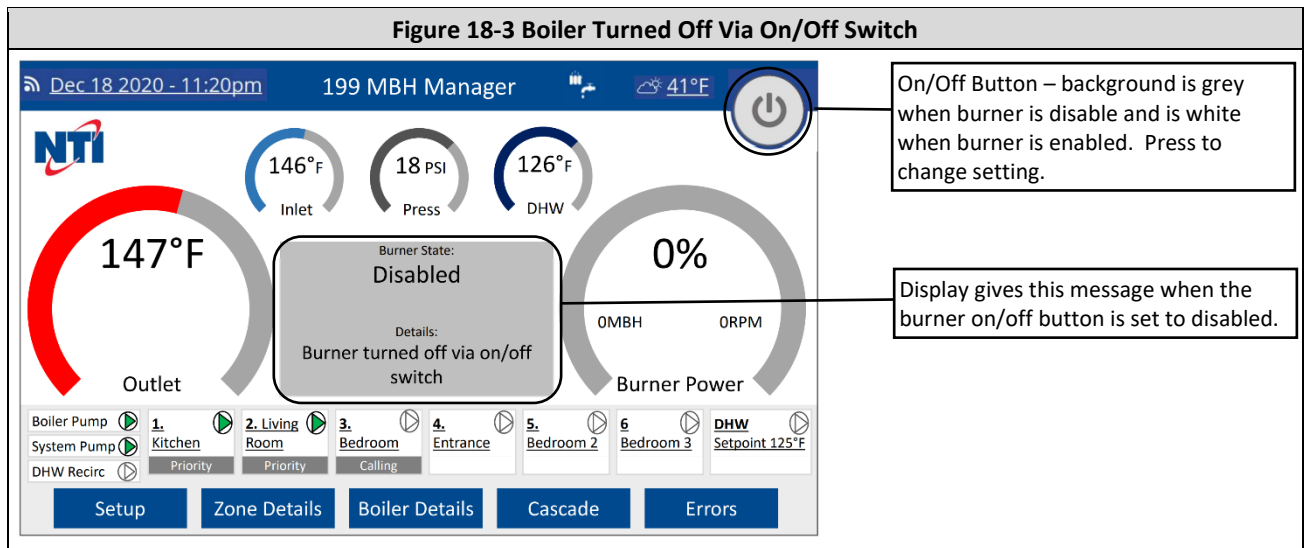
**NOTE:** if the Outlet Temp is lower than the ON temperature, check the System Temp reading from the Boiler Details page. If a System Sensor is used, its reading must be lower than the ON temperature before the burner will turn on.

**NOTE:** if the Outlet (or System) Temp is lower than the ON temperature, and the Home Screen is still indicating “Boiler temperature in range”, then it is possible that the CH Anti-cycle Time counter has not elapsed; see [CH Setup](#) -> [General Advanced Settings](#).



3. **No Response to a Central Heat Demand** – if the boiler is not responding to a CH demand, i.e., Zone Status does not show “Priority” or “Calling” and the pump symbol does not turn green (see Figure 18-2), proceed as follows:
  - i. Check Scheduling setting for each zone to make sure it is set to Always Comfort; see Section [16.3.3 User Menu](#).
  - ii. Check the Operating Mode to make sure it is set to “Winter”; see Section [16.2 Operating Mode](#).
  - iii. Check the field wiring to the *T-STAT #1-3* inputs; verify that 24VAC is present on R and W. If 24V is preset on R but not on W, then the issue is with the thermostat. If 24V is not present on R, then check the 2 Amp blade-fuse on the Low Voltage Connection PCB, see Figure 18-4.
 

**NOTE:** if the 2 Amp fuse is blown, check for correct field wiring to the *T-STAT #1-3* inputs.
  - iv. Check the Zone Controller Fuses; see Figure 18-4.
4. **Boiler Turned Off Via On/Off Switch** – if this message is shown on the Home Screen it means that the burner was disabled via the on/off button at the top-right of the screen (see Figure 18-3); press the on/off button to enable the burner.



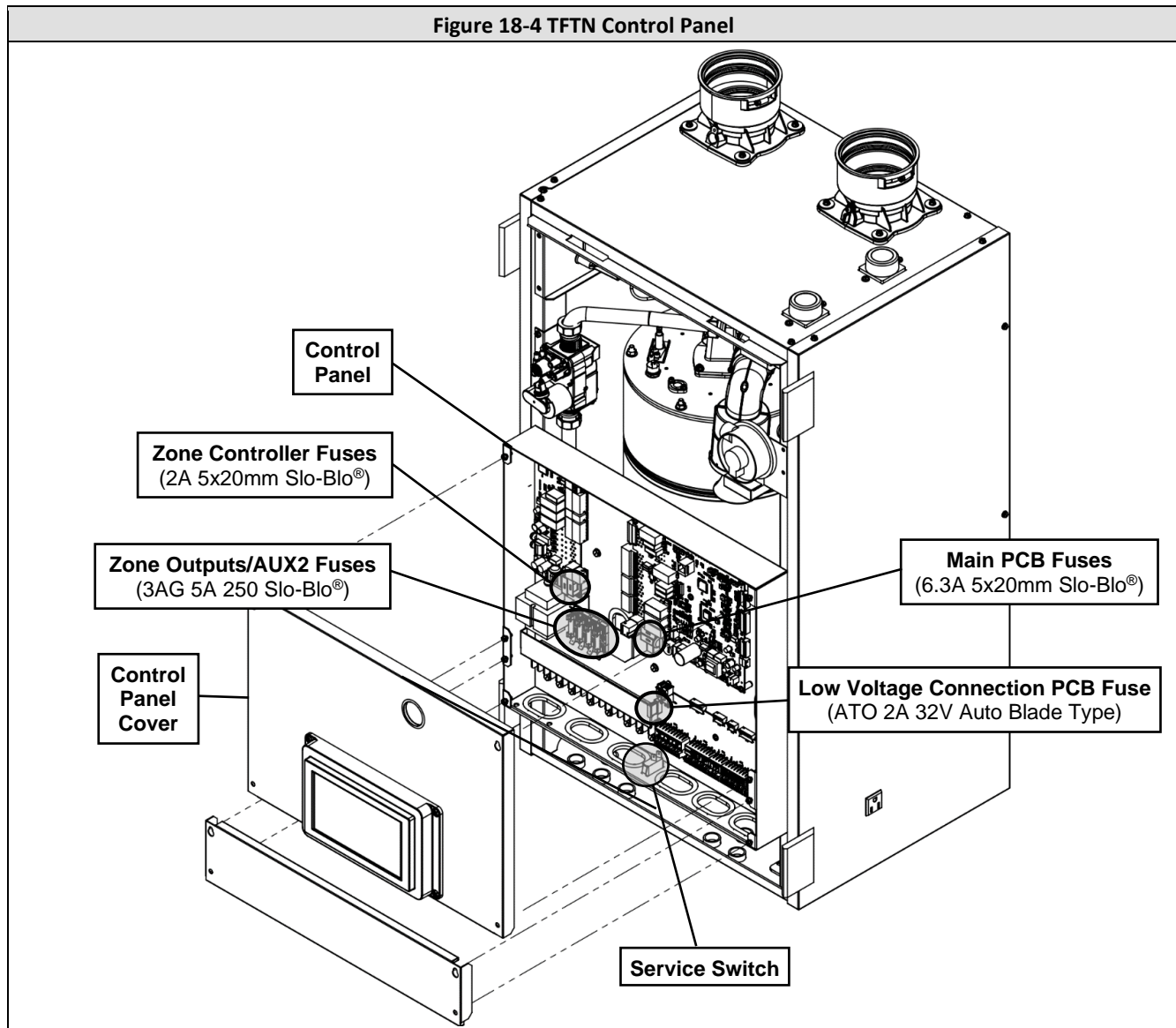
5. **No Power to Zone Outputs:**
  - i. Confirm that the jumper wire is connected between terminals *ZONE INPUT* and *120V*, or *ZONE INPUT* and *R* (for 24V loads); see Figures 12-2 & 12-3.
  - ii. Check the Zone Output fused on the Control Panel; see Figure 18-4.

**NOTE:** if the display is not indicating that the zone output is on, i.e., pump symbol does not turn green (see Figure 18-2) then the boiler is not attempted to turn the zone output on.

**NOTE:** zone outputs will not turn on if there is a priority demand for DHW.

## 6. Display is Blank:

- i. Confirm that the service switch located at the bottom of the control panel (see Figure 18-4) is in the on position.
- ii. Confirm that 120VAC is applied to terminals *LINE* and *NEUTRAL*; see section [12.0 FIELD WIRING](#).
- iii. Remove the control panel cover and check the cable connecting the display to the main PCB; see Figure 18-4.
- iv. Check the Main PCB Fuses; see Figure 18-4.



## Fuses

The TFTN boiler is equipped with nine (9) fuses – see Figure 18-4. Check these fuses before replacing any of the controllers or other electrical component; if the fuse is blown, it will prevent the protected device(s) from functioning.



**WARNING**

If replacing a fuse, only replace with an equivalent version – see Figure 18-4. Failure to follow this warning may result in component failure, fire, property damage, serious injury or death.

**Main PCB Fuses (120VAC)** – the main PCB is equipped with two (2) 6.3 Amp Slow-blow fuses (one each on the Line and Neutral) that protect most 120VAC circuits within the boiler, as well as the *BLR*, *DHW*, and *AUX1 PUMP* outputs.

**Zone Controller Fuses (120VAC)** – the zone controller is equipped with two (2) 2 Amp Slow-blow fuses (one each on the Line and Neutral).

**Zone Output & AUX1 Fuses (120VAC)** – 5 Amp fuses, located on the control panel, protect each of the zone outputs (*ZONE 1*, *ZONE 2*, and *ZONE 3*) and the *AUX2 PUMP* output.

**Low Voltage Connection PCB Fuse (24VAC)** – a 2 Amp automotive style blade fuse, located on the low voltage connection PCB, protects all 24VAC circuits within the boiler.

## Error Codes

There are various types of errors, some are blocking (i.e., Manual & Auto Reset type) and required intervention to restore boiler operation, while others are informational (i.e., Warnings) and do not directly block boiler operation.

### Error Types:

- Manual Reset – must be cleared from the [Home Screen](#) (by selecting “Press to RESET”) or the [Errors](#) -> Active Errors menu (by selecting “Press to reset active errors”) before the boiler will attempt to resume normal operation.
- Auto Reset – block the boiler from firing but will reset automatically when the error condition is resolved.
- Warning – are informational only and do not block the boiler from firing; however, the warning may be an indication that certain functions are no longer operational and therefore need attention.

**Table 18-1 Error Codes**

Error Code	Problem	Possible Remedy	Error Type
101 1 – Overheat	Inlet or Outlet temperature exceeded 210°F	Lack of water flow – verify that the pump is getting powered and that there is proper water circulation.	Manual Reset
		Faulty wiring – check the wiring to the Inlet and Outlet sensors for water or corrosion	
	Faulty sensor – check for proper readings from the boiler Outlet and Inlet temp sensors (see Table 18-2).		
Burner plate thermal switch tripped	Remove wires from thermal switch and check switch for continuity. If switch is open inspect the inside of the combustion chamber for damaged or missing insulation. <b>DO NOT OPERATE THE BOILER!</b>		
102 – Pressure sensor error	Water pressure sensor disconnected	Faulty wiring – ensure the wire harness is connected to the water pressure sensor. Check for broken wires	Warning
		Faulty sensor – replace pressure sensor	
103 1 – Flow check failed (Return or Supply Temp Changed Too Quickly)	Outlet or Inlet T-rise > 12.6°F/sec (3x in a row)	Lack of water flow – verify that the pump is getting powered and that there is proper water circulation.	Manual Reset
		Faulty wiring – check the wiring to the Inlet and Outlet sensors for water or corrosion	
		Faulty sensor – check for proper readings from the boiler Outlet and Inlet temp sensors (see Table 18-2).	
104 1 – Flow check failed (Return or Supply Temp Changed Too Quickly)	Outlet or Inlet T-rise > 27°F/sec (3x in a row)	Lack of water flow – verify that the pump is getting powered and that there is proper water circulation.	Manual Reset
		Faulty wiring – check the wiring to the Inlet and Outlet sensors for water or corrosion	
		Faulty sensor – check for proper readings from the boiler Outlet and Inlet temp sensors (see Table 18-2).	
105 1 – Flow check failed (Sensor Delta T Too High)	Delta-T > 63°F (3x in a row)	Lack of water flow – verify that the pump is getting powered and that there is proper water circulation.	Manual Reset
		Faulty wiring – check the wiring to the Inlet and Outlet sensors for water or corrosion	
		Faulty sensor – check for proper readings from the boiler Outlet and Inlet temp sensors (see Table 18-2).	
106 1 – Flow check failed (flow inversion detected)	Inlet > Outlet temp by 18°F (3x in a row)	Reversed piping – verify that the water is flowing through the boiler in the correct direction.	Manual Reset
		Lack of water flow – verify that the pump is getting powered and that there is proper water circulation.	
		Faulty wiring – check the wiring to the Inlet and Outlet sensors for water or corrosion	
		Faulty sensor – check for proper readings from the boiler Outlet and Inlet temp sensors (see Table 18-2).	

Error Code	Problem	Possible Remedy	Error Type
109 – High pressure CH	Water pressure > Max pressure setting (parameter 24.3.3)	Water pressure too high – reduce water pressure. Confirm correct functioning/installation of the pressure regulator and expansion tank.	Warning
		Max pressure setting too low – increase Max pressure setting (parameter 24.3.3).	
		Faulty wiring – ensure the wire harness is connected to the water pressure sensor. Check for broken wires	
		Faulty sensor – replace pressure sensor	
110 1 – Supply Sensor	Outlet temp sensor reads as an open or closed circuit	Faulty wiring – check the wiring to the Outlet sensor for water or corrosion	Auto Reset
		Faulty sensor – check for proper readings from the boiler Outlet temp sensor (see Table 18-2).	
112 1 – Return Sensor	Inlet temp sensor reads as an open or closed circuit	Temp too low – warm sensor until return temp rises	Auto Reset
		Faulty wiring – check the wiring to the Inlet sensor for water or corrosion	
		Faulty sensor – check for proper readings from the boiler Inlet temp sensor (see Table 18-2).	
113 – Low water cut off fault	LWCO circuit is open	Low water – ensure the boiler is free of air and pressurized to at least 12 PSI. Take care to install the auto air-vent on the outlet pipe above the LWCO	Auto Reset
		Blown 24V fuse – If the power light is not on at the LWCO, check the 2A blade fuse on the Low Voltage Connection PCB; see Figure 18-4.	
		Faulty wiring – check the wiring to the LWCO for water or corrosion	
		Faulty LWCO – replace the LWCO	
114 – Outdoor temperature not available	Outdoor temperature reading is not available	Connect an outdoor sensor to <i>OD NTC</i> . If an outdoor sensor is already connected, check the connections and wiring...compare resistance to Table 18-2.	Warning
		If connected to WiFi, turn Internet Weather on; see <a href="#">Connectivity</a> section.	
		If using internet weather, make sure the boiler is connected to WiFi and registered with an address; see <a href="#">WiFi Connection</a> section.	
		If not using outdoor reset, adjust AUTO Temperature Control Mode accordingly, i.e., do not set to “Outdoor Temp”, or set to “Not active” globally from the Home Screen (press blinking house symbol)	
115 – Common flow sensor error	System sensor reading is invalid	System sensor not connected – if using a system sensor, it must be connected at <i>AUX1 NTC</i> . <b>NOTE:</b> Cascade applications require a system sensor to be connected to the Manager boiler.	Warning
		Auxiliary Sensor 1 set as System Sensor – if NOT using a system sensor, <a href="#">Auxiliary Sensor 1</a> setting (see <a href="#">Sensor Configuration</a> section) must NOT be set as System Sensor.	
		Faulty wiring – check the wiring to the System sensor for water or corrosion	
		Faulty sensor – check for proper readings from the System sensor (see Table 18-2).	
117 1 – Supply Sensor	Outlet temp sensor reads as an open or closed circuit	See error code 110 1	Auto Reset

Error Code	Problem	Possible Remedy	Error Type
118 1 – Primary Probes Test Fail	Inlet/Outlet temp sensor reading has not changed in 23 hours, even after firing the burner	Confirm that the inlet and outlet temperature sensors are properly installed, e.g., ensure that the clip-on sensors (TFTN085-199 models only) are properly clipped onto the piping.	Auto Reset
150 – Common flow sensor overheat	System sensor reading > 210°F	Faulty wiring – check the wiring to the System sensor for water or corrosion Faulty sensor – check for proper readings from the System sensor (see Table 18-2).	Auto reset
1P1 1 – Flow check failed (Supply Temp Change Fast)	Outlet T-rise > 12.6°F/sec	Normal operation – In systems with high and low temperature zones this message may be appear several times as zones turn off and on.	Warning
1P2 1 – Flow check failed (Sensor Delta T Too High)	Delta-T > 63°F	Normal operation – In systems with high and low temperature zones this message may be appear several times as zones turn off and on.	Warning
1P3 1 – Flow check failed (Flow inversion detected)	Inlet > Outlet temp by 18°F	Normal operation – In systems with high and low temperature zones this message may be appear several times as zones turn off and on.	Warning
1P4 – Low Water Pressure	Water pressure reading < 7 psi	Low water pressure – raise the water pressure to a minimum of 12 psi Faulty wiring – ensure the wire harness is connected to the water pressure sensor. Check for broken wires Faulty sensor – replace pressure sensor	Warning
203 – DHW Sensor	DHW tank sensor reading is invalid	Incorrect setting – DHW Mode is set as “Tank Sensor”, but a tank sensor is not being used. Change DHW Mode setting to “Aquastat” Tank sensor not connected – Connect IWH tank sensor to <i>DHW SWITCH/NTC</i> Faulty wiring – check the wiring to the Tank sensor for water or corrosion Faulty sensor – check for proper readings from the Tank sensor (see Table 18-2).	Warning
209 – Storage tank overheat	Tank sensor temp > 175°F	Plumbing problem – Boiler water is circulating through the IWH coil during CH serving – correct piping; see <a href="#">Boiler System Piping</a> section Tank sensor improperly installed – ensure the tank sensor is fully inserted into the well of the tank in the proper location. Faulty wiring – check the wiring to the Tank sensor for water or corrosion Faulty sensor – check for proper readings from the Tank sensor (see Table 18-2).	Warning
2P2 – Anti-legionella function not finished (See over...)	Anti-legionella function is not complete (to reset, switch the power to the boiler off/on)	Anti-legionella Function turned on – if the anti-legionella function is not wanted, then set <a href="#">Anti-Legionella Function</a> = Off (see <a href="#">DHW Setup</a> ) Boiler setting to low – set DHW <a href="#">Modulation Setpoint</a> = 180°F or higher (see <a href="#">User Menu</a> ) Tank sensor improperly installed – ensure the tank sensor is fully inserted into the well of the tank in the proper location. Faulty wiring – check the wiring to the Tank sensor for water or corrosion	Warning

Error Code	Problem	Possible Remedy	Error Type
(...continued) 2P2 – Anti-legionella function not finished		Faulty sensor – check for proper readings from the Tank sensor (see Table 18-2). Plumbing problem – verify that boiler water is circulating to the IWH coil; see <a href="#">Boiler System Plumbing</a> section	
303 – PCB internal error	PCB internal error (to reset, switch the power to the boiler off/on)	Water pressure sensor wiring damaged or shorted: 1. Check the water pressure switch wiring for damage or shorts 2. Test for proper voltage and grounding. Power problem – test for proper voltage and grounding. Faulty PCB – if the problem persists, replace the PCB	Manual Reset
304 – Too many resets	> 5 resets in 15 minutes (to reset, switch the power to the boiler off/on)	Check error history (see <a href="#">Error</a> section) and correct the source of the respective fault codes.	Manual Reset
306 – PCB internal error	PCB internal error (to reset, switch the power to the boiler off/on)	Power problem – test for proper voltage and grounding. Faulty PCB – if the problem persists, replace the PCB	Manual Reset
309 – flame detection while burner is off		Damaged flame sensor or flame sensor wire – check flame sensor and flame sensor wire for damage, replace flame sensor Water damage – check flame sensor and PCB for water damage or corrosion Flooded combustion chamber – If the condensate drain was blocked and the chamber flooded, dry the chamber and flame sensor PCB internal fault – If the Flame sensor wire is good and the flame sensor has been replaced, replace the PCB	Manual Reset
3P9 – Sched. Maintenance-Call for Service	Months to next maintenance time has elapsed	Service the boiler and select RESET from the Setup -> Diagnostics -> Service menu; see <a href="#">Diagnostics</a> section.	Warning
411 – Room sensor circuit open or short circuit Zone 1	Room sensor circuit open or short circuit Zone 1	BUS wiring damaged – Inspect BUS wiring for bad connections Missing NTI Room Sensor – if using an NTI Room Sensor for Zone 1, then check that it is properly connected to the BUS and confirm its correct zone association. Incorrect Zone 1 AUTO Temperature Control Mode setting – if not using an NTI Room Sensors for Zone 1, then confirm that Zone 1 <u>AUTO Temperature Control Mode</u> is not set to <u>Room Temp</u> or <u>Room&amp;Outdoor</u> .	Auto Reset
412 – Room sensor circuit open or short circuit Zone 2	Room sensor circuit open or short circuit Zone 2	BUS wiring damaged – Inspect BUS wiring for bad connections Missing NTI Room Sensor – if using an NTI Room Sensor for Zone 2, then check that it is properly connected to the BUS and confirm its correct zone association. Incorrect Zone 2 AUTO Temperature Control Mode setting – if not using an NTI Room Sensors for Zone 2, then confirm that Zone 2 <u>AUTO Temperature Control Mode</u> is not set to <u>Room Temp</u> or <u>Room&amp;Outdoor</u> .	Auto Reset
413 – Room sensor circuit open or short circuit Zone 3 (See over...)	Room sensor circuit open or short circuit Zone 3	BUS wiring damaged – Inspect BUS wiring for bad connections Missing NTI Room Sensor – if using an NTI Room Sensor for Zone 3, then check that it is properly connected to the BUS and confirm its correct zone association.	Auto Reset



Error Code	Problem	Possible Remedy	Error Type
(...continued) 413 – Room sensor circuit open or short circuit Zone 3		Incorrect Zone 3 AUTO Temperature Control Mode setting – if not using an NTI Room Sensors for Zone 3, then confirm that Zone 3 <u>AUTO Temperature Control Mode</u> is not set to <u>Room Temp</u> or <u>Room&amp;Outdoor</u> .	
441 – Follower Boiler Missing from BUS	Follower Boiler Missing from BUS	Single boiler configured as a Manager boiler – if this is a stand-alone boiler, set Boiler Address = Single Boiler, see <a href="#">Cascade Setup</a> section Follower BUS wires disconnected – Inspect BUS wiring for damage or shorts, BUS wiring is polarity sensitive. Follower boiler turned off – ensure power is on for all boilers in cascade	Warning
460 – External safety lock	Open circuit at <i>AUX LIMIT</i>	External limit switch wired to <i>AUX LIMIT</i> input is open – check device. If an external limit switch is not being used, place a jumper across <i>AUX LIMIT</i> . NOTE: error type is Manual Reset if parameter 24.6.5 is set to “Safety lock <u>not</u> volatile”	Auto Reset
501 1 – Ignition failed (x4)	Boiler failed to sense flame signal during ignition (4x in a row)	Improper Gas pressure – verify that the gas pressure during an ignition attempt is within the range specified in section <a href="#">9.0 Gas Valve and Burner Setup</a> . Blocked air-intake – remove front cover and inspect the venturi and boiler air inlet silencer for debris. Blocked exhaust – inspect exhaust for proper slope to boiler and possible restrictions or blockages Blocked condensate drain – inspect condensate drain, if the drain was clogged water may have entered the gas valve. If the valve was wet, it must be replaced. Improper LP conversion – check conversion instructions, increase the gas flow by adjusting the input screw. **A combustion test must be performed if the gas valve is adjusted. No spark – inspect the igniter for cracks or warping (electrode gap should be 3/16"-1/4"). With the gas supply valved off and the igniter removed, observe the spark during the trial for ignition – it should spark for 3-5 seconds. If there is no spark check that the spark transformer receives 120VAC during the ignition trial. Improper combustion settings – adjust the gas valve Throttle Screw to increase the gas flow. Once the boiler remains lit set combustion. See section <a href="#">9.0 Gas Valve and Burner Setup</a> . Warning: this process may only be performed by a qualified technician with a combustion analyzer Faulty flame sensor – if the boiler lights well and has a strong flame, replace the flame sensor, and inspect the flame sensor harness for shorts or damage.	Manual Reset
502 – Flame detected out of sequence	Flame detected before the gas valve was turned on	Faulty flame sensor – check the flame sensor and wiring for damage, water, or other possible shorts to ground (replace flame sensor) Faulty PCB – if problem persists, replace the PCB.	Auto Reset
504 1 – Flame lost ten times during run (See over...)	Flame signal lost during run (10x in a row)	Improper Gas pressure – verify that the gas pressure during an ignition attempt is within the range specified in section <a href="#">9.0 Gas Valve and Burner Setup</a> .	Manual Reset

Error Code	Problem	Possible Remedy	Error Type
(...continued)  504 1 – Flame lost ten times during run		Improper combustion settings – test combustion at Max and Min Power as per section <a href="#">9.0 Gas Valve and Burner Setup</a>	
		Restricted air-intake or exhaust – check for restrictions	
		Dirty combustion chamber or burner – clean the combustion chamber and burner	
		Dirty or fault flame sensor – clean the flame sensor with a mild abrasive or replace the flame sensor.	
		Blocked condensate drain – ensure the condensate drain is clear and drains freely	
5P1 – 1st Ignition Failed	Flame signal did not meet the minimum threshold on the 1 <sup>st</sup> ignition attempt	Normal operation – 5P1 may be displayed momentarily if there is a problem the boiler will lock out. Follow the directions for the lockout	Warning
5P2 – 2nd ignition attempt failed	Flame signal did not meet the minimum threshold on the 2 <sup>nd</sup> ignition attempt	See lockout 501	Warning
5P6 – 3rd ignition attempt failed	Flame signal did not meet the minimum threshold on the 3 <sup>rd</sup> ignition attempt	See lockout 501	Warning
5P3 – Detection of Flame loss during run	Flame signal was lost during run	Wind – in some applications the flame will occasionally lift during run due to excessive wind	Warning
		Blocked venting – ensure nothing is obstructing the venting	
		Combustion settings or Gas pressure – if the problem is persistent a lockout will result, follow the trouble shooting for the lockout. If the flame loss is bothersome and does not result in a lockout, see error 504.	
602 – Flue sensor or flue too hot	Exhaust temperature exceeded 200°F (the error can only be cleared when the flue temperature drops below 190°F for 1 minute)	Inadequate water flow – ensure the boiler water is free of air and pressurized to a minimum of 12 psi	Manual Reset
		Dirty Combustion chamber – ensure the combustion chamber is cleaned regularly	
		Water scaling – if the error is accompanied by popping or hissing, the boiler may have scale build-up preventing proper heat transfer. Descale the heat exchanger if needed.	
		Faulty wiring – check the wiring to the Flue sensor for water or corrosion	
		Faulty sensor – check for proper readings from the Flue sensor (see Table 18-2).	
603 1 – APS open	Blocked condensate switch opened	Blocked Condensate – ensure the condensate is draining freely and the tubing to the switch is clear	Manual Reset
		Blocked vent – check the exhaust and air-intake venting for blockages.	
		Wiring problem – inspect the wires from the air switch to the boiler control. Disconnect and reconnect each connection	
		Air switch failure – replace the air switch	

Error Code	Problem	Possible Remedy	Error Type
605 – Flue sensor open circuit	Flue sensor reading is invalid	Faulty wiring – check the wiring to the Flue sensor for water or corrosion	Auto Reset
		Faulty sensor – check for proper readings from the Flue sensor (see Table 18-2).	
612 1 Fan Speed Too Low Blower	Fan speed did not achieve the correct speed	Faulty wiring – check the 4-wire harness between the fan and PCB for damage and check it for continuity. On the 3-wire harness, verify 120VAC between black and white.	Manual Reset
		Faulty fan – remove the 4-wire harness from the fan, if it does not run at high speed replace the fan.	
		Faulty PCB – if the wiring and fan are ok, replace the main PCB.	
730 – Buffer high probe error	Buffer tank function is enabled but there is no sensor detected at either the AUX 1 or 2 NTC input	Incorrect setting – Buffer Tank Function is set as “Fixed or Variable Temperature”, but a buffer tank sensor is not being used. Change Buffer Tank Function setting to “Off”	Warning
		Buffer tank sensor not connected or configured – Connect buffer tank sensor to AUX 1/2 NTC and configure the respective sensor input as “Buffer Tank”	
		Faulty wiring – check the wiring to the buffer tank sensor for water or corrosion	
		Faulty sensor – check for proper readings from the buffer tank sensor (see Table 18-2).	
Unconfigured – It’s needed to configure the device, press OK to proceed	Boiler is configured as a Follower, but it does not see a Manager boiler connected to the BUS	Faulty wiring – if the boiler is a Follower in a cascade system, check the BUS wiring to each boiler. Note: BUS wiring is polarity sensitive.	
		Missing Manager – configure one of the boilers in cascade as Manager; see section <a href="#">11.0 - Cascade Installation</a> .	
		Incorrect setting – if application is a stand-alone boiler, set Boiler Address = Single Boiler. Press OK and select Single boiler under Available Configurations	
Conflict	BUS conflict	Incorrect settings – two or more boilers in the cascade have been set with the same Boiler Address. Disconnect each from the BUS and set a unique Boiler Address at each boiler.	
		Multiple zone controllers with dip switches set to on – there can only be two zone controllers connected to the BUS, and only one can have the dip switches set to on; see section <a href="#">11.0 - Cascade Installation</a> .	

Table 18-2 Thermistor Resistance vs. Temperature

Temp °F (°C)	Resistance Ohms (Ω)	Temp °F (°C)	Resistance Ohms (Ω)
-22 (-30)	176,133	122 (50)	3,603
-4 (-20)	96,761	131 (55)	2,986
14 (-10)	55,218	140 (60)	2,488
32 (0)	32,650	149 (65)	2,083
41 (5)	25,390	158 (70)	1,752
50 (10)	19,900	167 (75)	1,481
59 (15)	15,710	176 (80)	1,258
68 (20)	12,490	185 (85)	1,072
77 (25)	10,000	194 (90)	918
86 (30)	8,057	203 (95)	789
95 (35)	6,531	212 (100)	680



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