Trinity Tft

Model Numbers: Tft60 - 399
Version Date: 2015-06-24

INSTALLATION AND OPERATION INSTRUCTIONS FOR TRINITY Tft BOILER

TABLE OF CONTENTS

HAZARD SYMBOLS AND DEFINITIONS

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

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

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

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

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

⚠ WARNING 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.

Visit us online

NTI # 84535

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 Section 14.0 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

General Installation Requirements

The installation of your NTI Trinity Tft gas 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 Trinity boiler model Tft. 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:

1. Installation and Operating Instructions,
2. Appendix A – Controller and Touchscreen Display Instructions,
3. Trinity Users 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.

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

IMPORTANT **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.

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 14 – Annual Maintenance and Inspection).

⚠ WARNING 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.

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

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 their obligation with respect to the above description under "User Responsibilities". Failure to follow this warning could result in fire, serious injury, or death.

⚠ DANGER

Failure to use the appropriate Natural to LP Conversion Kit and Orifice when operating the Trinity Tft with Propane will result in extremely dangerous burner operation leading to property damage, serious injury or death. Refer to section titled **ATTENTION: LIQUEFIED PETROLEUM (LP) PROPANE** for applicable conversion kit and LP orifice numbers.

ATTENTION: LIQUEFIED PETROLEUM (LP) PROPANE

The Trinity Tft is factory set to operate with Natural Gas. BEFORE OPERATING WITH PROPANE, the specified LP Conversion Kit and Orifice must be installed to convert the boiler so it will operate safely with LP Propane. The correct kit and LP orifice is listed below (Each kit comes with conversion instructions).

Liquefied Petroleum (LP) propane gas is heavier than air; therefore, it is imperative that your Trinity Tft boiler is not installed in a pit or similar location that will permit heavier than air gas to collect. Local Codes may require boilers fueled with LP gas be provided with an approved means of removing unburned gases from the room. Check your local codes for this requirement.

	Natural to LP Propane Conversion Kit	
Model Number	**Kit Number**	**LP Orifice**
Tft60-85	**82650-1**	**415 (4.15mm)**
Tft110	**82650-1**	**52 (5.2mm)**
Tft155-250	**82650-1**	**62 (6.2mm)**
Tft300-399	**84471-1**	**74 (7.4mm)**

Boiler Vent / Air-Inlet Piping

⚠ DANGER

The Trinity Tft 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.

IN THE STATE OF MASSACHUSETTS ONLY

(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 can not 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 Trinity Tft Specifications

DESCRIPTION	Tft60	Tft85	Tft110	Tft155	Tft175	Tft200	Tft250	Tft300	Tft399
CSA Input Modulation [1,4] [MBH]	17-60	17-85	21.6-108	31-155	31-175	31-200	31-250	79.8-299	79.8-399
DOE Heating Capacity [1,2] [MBH]	56	78	99	144	163	185	230	278	380
Net I=B=R Rating [1,2] [MBH]	48	68	86	125	141	160	199	239	330
DOE AFUE [2] [%]	95	95	95	95	95	95	95	94	95.4
Water Connections – NPT [in.]	1 (Male)			1-1/4 (Male)				1-1/2 (Male)	
Gas Connection - NPT, in.	½ (Male)							¾ (Male)	
Vent/Air-inlet Pipe Diameter [in.] [3]	2 or 3			3				4	
Dimensions H x W x D [in.]	33-3/8 x 19-3/4 x 14-1/2			33-3/8 x 19-3/4 x 18-1/2				36-3/8 x 25-1/4 x 20	
Approx. Boiler Weight with Water [lbs]	110			180				250	
Approx. Boiler Water Content [Gallons]	3.2			4.9				6.4	
Electrical Rating	120V/1Ph/60Hz/less than12A								

Notes:
[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 then 2000ft.
[2] Ratings based on standard test procedures prescribed by the U.S. Department of Energy; certified by AHRI. Tft399 efficiency represents Thermal Efficiency (AFUE is not applicable).
[3] Trinity Tft requires a special venting system, use only vent materials and methods detailed in these instructions.
[4] When operating with Propane models Tft60, Tft85 and Tft110 have min/max Input Modulation rates of 17/65, 17.6/88 and 22.6/113 MBH respectfully.

⚠ CAUTION Wall mounting of unit requires two people to lift the boiler into place. Failure to follow these instructions may result in property damage or personal injury.

High Altitude Operation

The Trinity Tft 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 [610 m]	3000 ft [914 m]	4000 ft [1219 m]	4500 ft [1372 m]	5000 ft [1524 m]
In Canada [1]	de-rate by 10%	de-rate by 10%	de-rate by 10%	de-rate by 10%	de-rate % may vary
In USA [2]	-	de-rate by 12%	de-rate by 16%	de-rate by 18%	de-rate by 20%

Notes:
[1] Canada: Altitudes between 2000-4500 ft [610-1372 m], de-rate by 10%. Consult local authorities for de-rating capacities for altitudes above 4500 ft [1372 m].
[2] USA: De-rate capacity by 4% for every 1000 ft [305 m], if altitude is above 2000 ft [610 m].

⚠ WARNING **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 <u>Installers responsibility</u> to check the combustion and to adjust the combustion in accordance with Section 9.0.** Failure to follow these instructions may result in property damage, serious injury, or death.

3.0 BOILER LOCATION

In all cases, the Trinity Tft 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.

Boiler Area Ventilation Air Openings

Direct Vent – If boiler area clearances are less than the recommended clearances specified in Table 3-1, the boiler area must be ventilated (**Exception**: if the boiler area/room has a volume of 150 ft^3 or greater, ventilation of the boiler room is not required). Each ventilation air opening must meet the minimum requirements of 1 in^2 per 1000 Btu/hr, but not less than 100 in^2. 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 Table 3-1, and if the boiler area has a volume less than 150 ft^3, 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 4-4 for a list of approved materials. Under all circumstances, the minimum clearances listed in Table 3-1 must be provided.

Indoor Combustion Air – When using Indoor Combustion Air in lieu of Direct Vent air-inlet 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 as shown in Figure 3-1, each providing a minimum area equal to 1 in^2 per 1000 Btu/hr, but not less then 100 in^2 and within 6" of the top and bottom of the closet door. See Table 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 then 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 Table 3-1for minimum clearances.

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.

Wall Mounting Installations

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

Table 3-1 Minimum Clearances for Installation and Service

Model No.	Clearances	Dimensions - inches [mm]					
		Front	Top	Sides	Back	Bottom	Flue Pipe
Trinity Tft	Minimum	24 [610][1]	12 [305]	4 [102]	0	9 [229]	1 [25]
	Recommended	36 [914]	24 [610]	12 [305]	0	24 [610]	1 [25]

Notes:
[1] 6" if surface is removable allowing a minimum of 24" [610 mm] clearance (i.e. closet installation). See Ventilation Air Opening dimensions in Figure 3-1.

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

Figure 3-1 Closet Installation, Minimum Clearances

(Model Tft60-110 Shown)

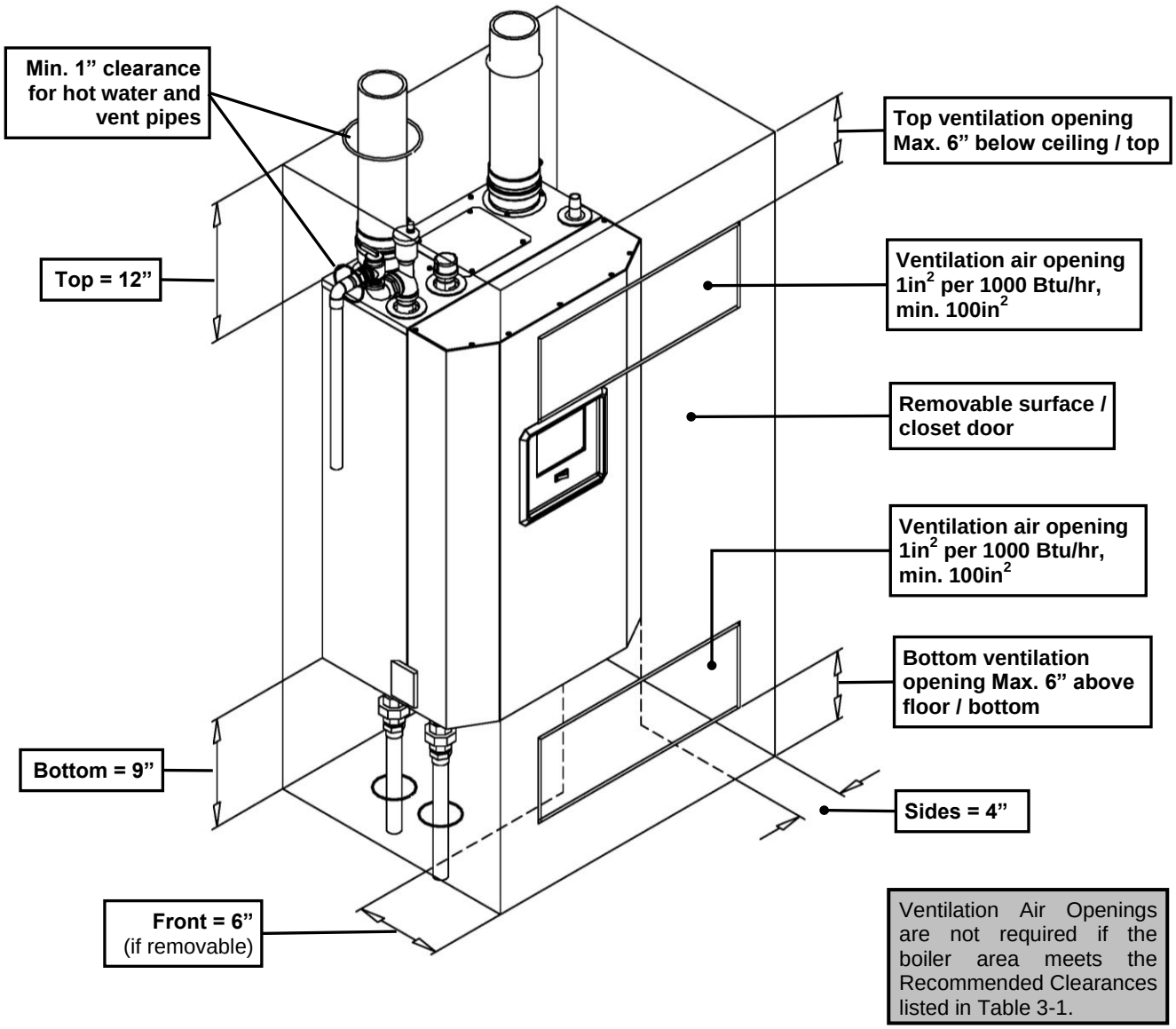


Figure 3-2 Wall Mounting Instructions

❶ While leaving the **Upper bracket (A)** intact, remove the **Wall-mount bracket (B)** attached to the bottom-back of the appliance. Save the mounting hardware for Step 4.

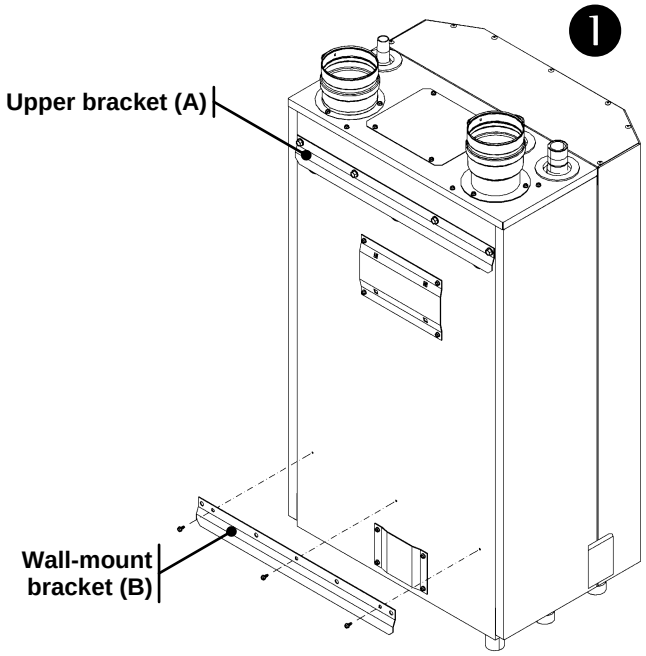
❷ Secure the **Wall-mount bracket (B)**, removed from the bottom of the boiler in Step 1, to a solid wall using field supplied lag screws (anchors when mounting to a concrete wall) that are adequate to support the weight of the appliance (refer to Table 2-1 Specifications). Ensure the Wall-mount bracket is mounted level and flush to the wall with mounting holes on the bottom, flange pointed upward and angled away from the wall.

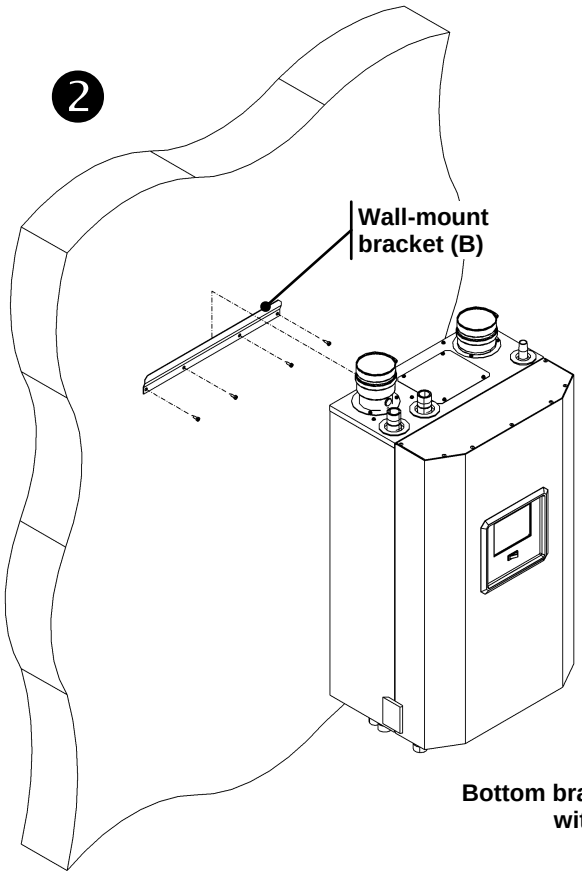
❸ Mount the appliance to the wall by aligning the **Upper bracket (A)** with the **Wall-mount bracket (B)**. Slide the Upper bracket down over the wall mount bracket until it hooks.

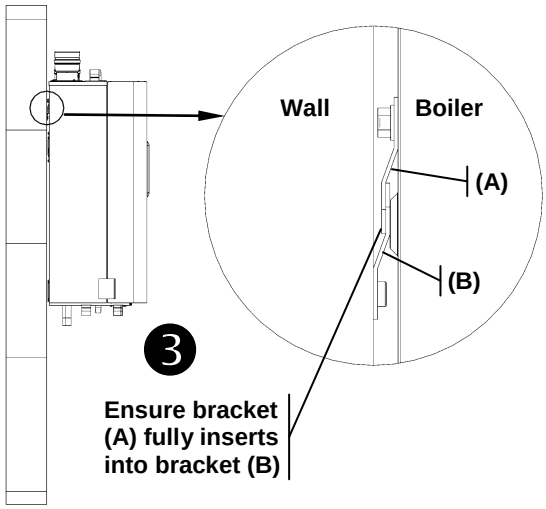
❹ Once the appliance is resting securely on the Upper bracket, secure the **Bottom bracket (C)** to the underside of the appliance using the mounting hardware removed in Step 1; then, anchor the bottom bracket to the wall as shown using field supplied hardware.

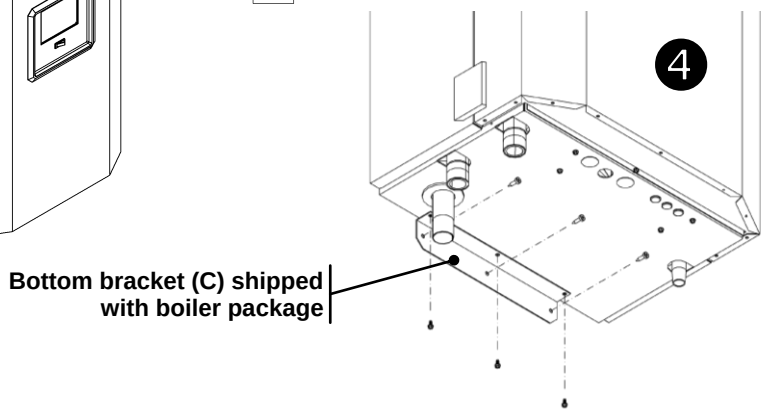
⚠ WARNING Failure to follow instructions may result in fire, serious injury, or death.

⚠ CAUTION This unit requires two people to lift it or damage and injury may result.









4.0 GENERAL VENTING

The Trinity Tft is certified as a "Category IV" boiler requiring a "Special Venting System" designed for pressurized venting. The Exhaust Vent 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.

⚠ DANGER Vent and Air-inlet are to be piped separately. The Trinity Tft cannot share a common vent or air-inlet 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.

Removing an Existing Boiler from Common Venting System

⚠ DANGER Do not install the Trinity Tft 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.

⚠ WARNING 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.

Direct Vent Installation

When installed as a Direct Vent boiler the combustion air-inlet 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.

Indoor Combustion Air (non-Direct Vent)

When the installation uses Indoor Combustion Air (i.e. piping is not directly connecting the appliance air-inlet fitting 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.

Combustion Air-inlet Contamination

Be careful not to locate the air-inlet 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-inlet 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

⚠ WARNING 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.

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

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-inlet pipe, explosive solvent vapors must be evacuated from the vent and air-inlet 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.

⚠ DANGER **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)

⚠ WARNING 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.

⚠ WARNING **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.

Near Boiler Vent/Air-inlet Piping

Each Trinity Tft is equipped with a short piece of approved CPVC vent pipe which is to be used when venting with PVC. Insert one end into the boiler flue outlet adapter and cement the other to the field venting (see Table 4-4 for approved venting material). The CPVC vent pipe should extend fully into the boiler flue outlet adapter (see Table 4-2). Ensure that the venting system does not apply a load or strain on the boiler flue outlet adapter. The manufacturer recommends using two elbows to create a "swing joint" to reduce potential strain on vent piping and cemented joints. See Figures 4-2 through 4-4 for illustrations.

⚠ WARNING **Gasket Seating** - Improper seating can cause leakage and eventual failure of the sealing gasket. Ensure the vent pipe is adequately beveled prior to inserting into the boiler flue adapter. Failure to follow these instructions may result in serious injury or death.

⚠ WARNING **PVC Exhaust Venting** – **DO NOT** insert PVC pipe directly into the appliance exhaust adapter, 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 pipe from the appliance adapter, resulting in property damage, serious injury or death.

⚠ WARNING **Polypropylene or Stainless Steel Venting** – When using Polypropylene or Stainless Steel piping, the appropriate appliance adapters must be used to transition the appliance vent connections to accept the respective Polypropylene or Stainless Steel venting. See Table 4-3 for a list of approved adapters. Failure to use the correct adapter will result in flue gas leakage resulting in property damage, serious injury or death.

Figure 4-2(a) Trinity Tft60-110 & 300-399
Near Boiler Venting (CPVC)

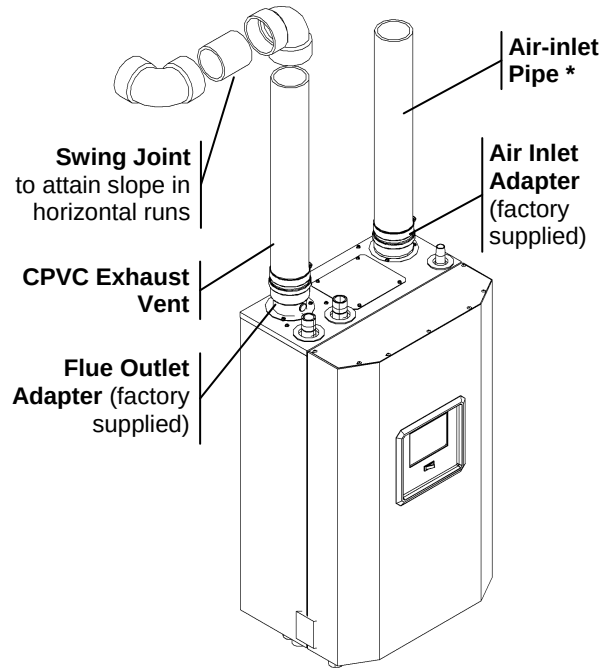


Figure 4-2(b) Trinity Tft60-110 & 300-399
Near Boiler Venting (PVC)

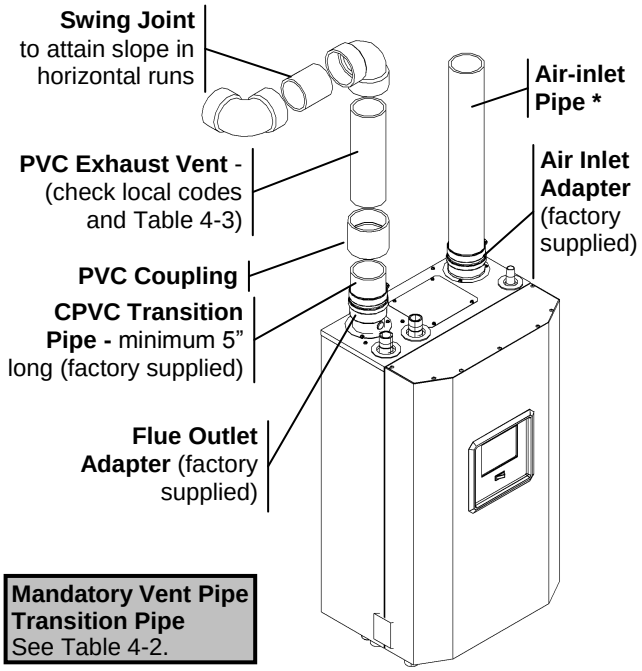


Figure 4-2(c) Trinity Tft155-250
Near Boiler Venting (CPVC)

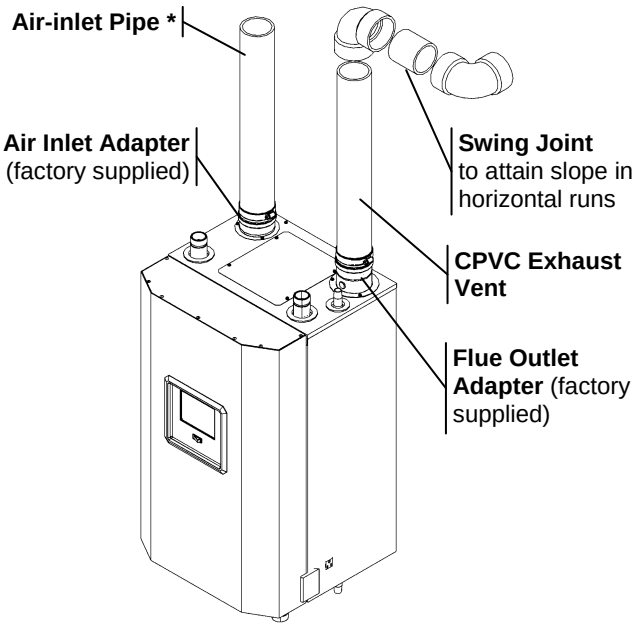
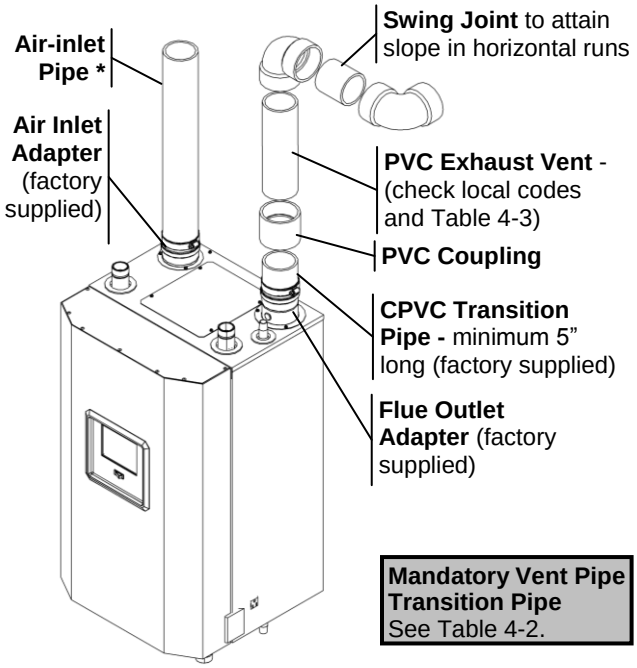


Figure 4-2(d) Trinity Tft155-250
Near Boiler Venting (PVC)



***** **Air-inlet** - check with applicable local codes for acceptable pipe material.

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

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

Figure 4-2(e) Trinity Tft60-110 & 300-399
Near Boiler Venting (Stainless Steel)

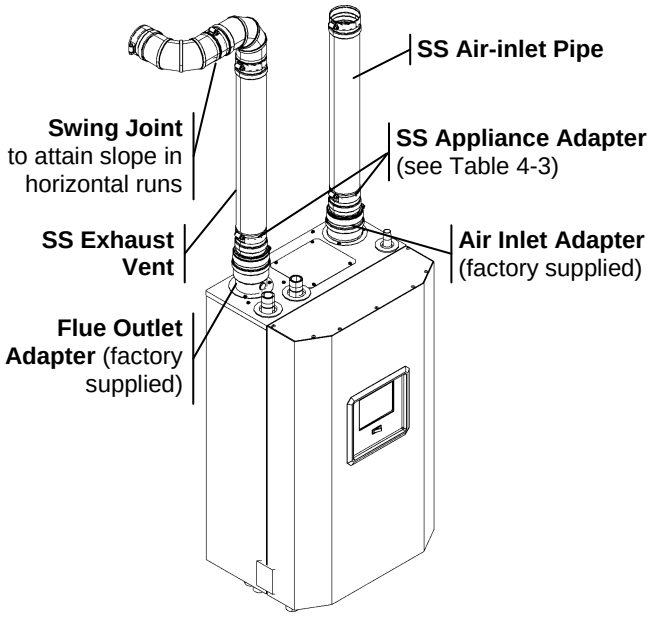


Figure 4-2(f) Trinity Tft60-110 & 300-399
Near Boiler Venting (Polypropylene)

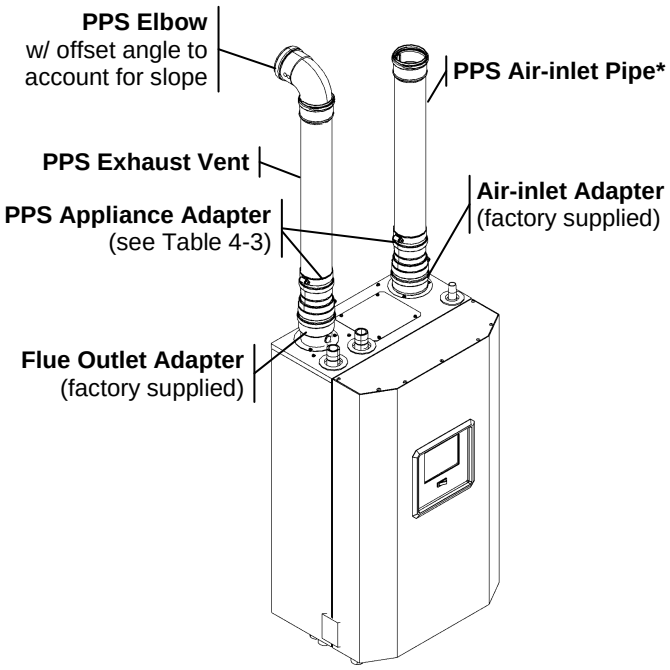


Figure 4-2(g) Trinity Tft155-250
Near Boiler Venting (Stainless Steel)

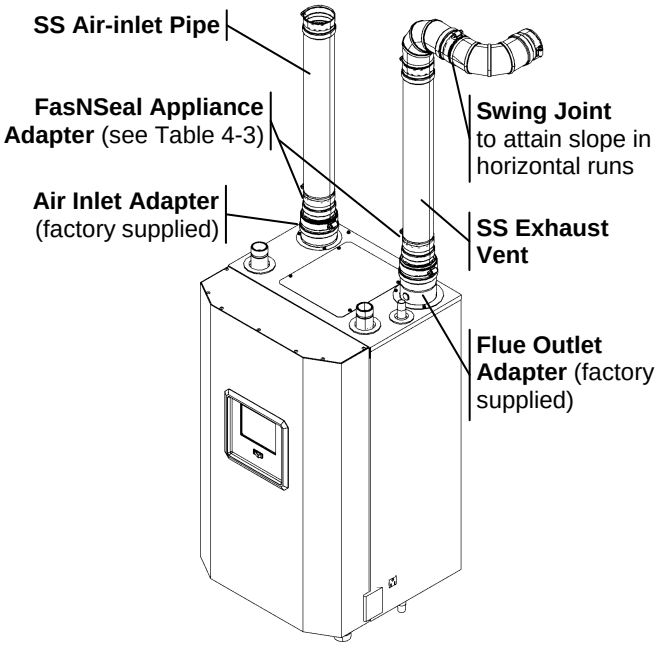
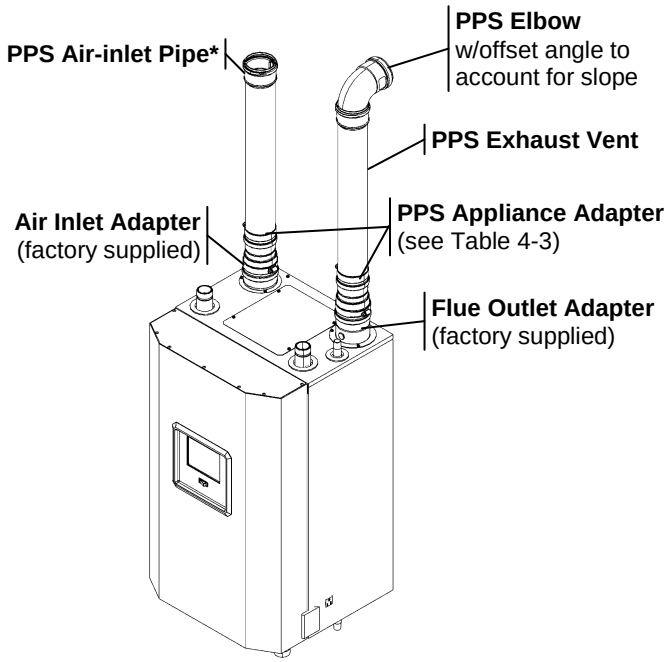


Figure 4-2(h) Trinity Tft155-250
Near Boiler Venting (Polypropylene)



***Air-Inlet** - check with applicable local codes for acceptable pipe material.

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

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

Table 4-2 CPVC Vent Pipe Transition Piece (used when venting with PVC)

Model No.	Vent Pipe Size	CPVC Transition Vent Pipe Length	Full Insertion Depth
Tft60-110	3”	Minimum 5” [127 mm]	2-7/8” [73 mm]
Tft155-250	3”	Minimum 5” [127 mm]	2-5/8” [67 mm]
Tft300-399	4”	Minimum 5” [127 mm]	2-5/8” [67 mm]

Table 4-3 Appliance Adapters for Polypropylene and Stainless Steel Venting

Model No.	Vent Material	Venting Brand	Adapter Part No. [1,2]
Tft60-250	Polypropylene	DuraVent – PolyPro	300150
		Centrotherm - InnoFlue	ISAA0303
	Stainless Steel	DuraVent – FasNSeal	300715
Tft300-399	Polypropylene	DuraVent – PolyPro	300151
		Centrotherm - InnoFlue	ISAA0404
	Stainless Steel	DuraVent – FasNSeal	303631

Notes:
[1] Listed appliance adapters are only approved for use with the respective venting brand; i.e. a PolyPro appliance adapter shall not be used with InnoFlue venting.
[2] PolyPro and FasNSeal appliance adapters are available from DuraVent (1-800-835-4429 or www.duravent.com); InnoFlue appliance adapters are available from Centrotherm Eco Systems (1-877-434-3432 or www.centrotherm.us.com).

Vent/Air-inlet Pipe Material

Table 4-4 Acceptable Vent and Air-Inlet Pipe Material

Items [1]	Materials [2, 3]	Venting System Standards	
		United States	Canada [4]
Vent Piping and Fittings	PVC - DWV	ANSI/ASTM D2265	All venting material in Canada must be **ULC S636 approved**. See Note 4 below for appropriate temperature applications.
	PVC Schedule 40	ANSI/ASTM D1785	
	CPVC Schedule 40	ANSI/ASTM F441	
	Stainless Steel (SS)	UL-1738	
	Polypropylene (PP)	-	
Pipe Cement	PVC	ANSI/ASTM D2564	
	CPVC	ANSI/ASTM F493	
Primers	PVC / CPVC	ANSI/ASTM F656	

⚠ WARNING

All Vent and Air-Inlet materials installed on gas fired appliances in CAN/US must meet the Standards listed in this Table. Failure to comply could result in fire, serious injury or death.

Notes:
[1] Refer to Table 4-5 for Allowable Vent and Air-Inlet Pipe Sizes and Lengths.
[2] PVC venting (exhaust and air-inlet) is not permitted within the Closet/alcove of a Closet/alcove installation.
[3] The Air-inlet does not require high temperature pipe material. Check applicable local codes for acceptable materials.
[4] ULC S636 PVC is approved for flue gas temperatures up to 149°F (65°C) and must only be used for low temperature applications. High temperature applications requiring boiler supply water temperatures greater than 140°F (60°C) must use ULC S636 CPVC, PP or SS.

⚠ WARNING 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.

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

Vent/Air-inlet Pipe Length Determination

Use Table 4-5 to determine the maximum pipe length that can be used. The table calculates 90º elbows, and 45º elbows at 5 equivalent feet each.

***Example*:** When using 3" pipe, a Tft60-110 can be installed with 150 equivalent feet of air-inlet piping and 150 equivalent feet of exhaust-vent piping. See Table 4-5 for more details.

NOTICE

Models Tft60-110 require a minimum equivalent exhaust vent length of 15'. When operating on Propane, models Tft60-110 require a minimum air-inlet length of 6' and 11' for 2" and 3" venting respectfully.

Table 4-5 Allowable Vent and Air-inlet Pipe Size and Lengths

Model No.	Pipe Size	Gas	Length (ft)	Number of Elbows (90's or 45's) and Equivalent Feet								
				1	2	3	4	5	6	7	8	9
Tft60-110	2" [1]	NG	100	95	90	85	80	75	70	65	60	55
Tft60-85		LP	35	30	25	20	15	10	5	-	-	-
Tft110			25	20	15	10	5	-	-	-	-	-
Tft60-110	3"	NG/LP	150	145	140	135	130	125	120	115	110	105
Tft155-250			100	95	90	85	80	75	70	65	60	55
Tft300-399	4"		100	95	90	85	80	75	70	65	60	55

Note:
[1] See WARNING below.

WARNING

PVC Exhaust Venting – When using 2" PVC venting with models Tft60-110, the first seven (7) equivalent feet of exhaust venting must be approved 2" CPVC or 3" PVC; see exceptions in Table 4-4 and Figures 4-2b and 4-2d.

Termination Options – Direct Vent Installation

The venting system of the Tft may be terminated using field supplied piping to construct a "Two-Pipe" termination, see Figures 4-3a, 4-4a, 4-4d, 4-5a, 4-6a and 4-6d; alternatively the venting may be terminated using a factory kit selected from Table 4-6. The "IPEX Low Profile" kit (see Figures 4-3b and 4-5c) and "M&G DuraVent Concentric (Wall)" kit (see Figures 4-3d and 4-5d) can be used for Sidewall terminations, while the "M&G DuraVent Concentric (Roof)" kit (see Figures 4-4c and 4-6c) can be used for Rooftop terminations; the "IPEX Concentric" kit (see Figures 4-3c, 4-4b, 4-5b and 4-6b) can be used for either Sidewall or Rooftop terminations.

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 4-4 and 4-6 for roof top venting options.

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 Vent/Air-inlet 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 – Direct Vent Installation

Kits certified with the Trinity Tft are listed in Table 4-6 and available from IPEX, DuraVent and/or NTI. For more information on System 636 Vent Kits or wholesaler locations contact IPEX directly **USA:** 1-800-463-9572 or www.IPEXamerica.com | **CAN:** 1-866-473-9462 or www.ipexinc.com. For more information on PolyPro Vent Kits or wholesaler locations contact DuraVent directly 1-800-835-4429 or www.duravent.com. For more information on InnoFlue Vent Kits or wholesaler locations contact Centrotherm directly at 1-877-434-3432 or www.centrotherm.us.com.

Table 4-6 Optional Vent Termination Kits

Description	Vent Size	Supplier P/N	Figure	Vent Material Compatibility	Vent Option	
					Roof	Wall
IPEX Low Profile (Flush Mount)[7]	2”	196984 (NTI P/N 85062)	4-3(b), 4-5(c)	PVC/CPVC[7]	×	✓
	3”	196985 (NTI P/N 84357)				
	4”	196986 (NTI P/N 84358)				
IPEX Concentric (Wall/Roof)[5,6,7,8]	2”	196125	4-3(c), 4-4(b), 4-5(b), 4-6(b)	PVC/CPVC[7]	✓	✓
	3”	196116 (NTI P/N 82666)				
		197117				
	4”	196021 (NTI P/N 84355)				
		197021				
DuraVent - PolyPro Concentric (Wall)	2”	2PPS-HK	4-3(d), 4-5(d)	PVC/CPVC/PP	×	✓
	3”	3PPS-HK				
	4”	4PPS-HK				
DuraVent - PolyPro Concentric (Roof)	2”	2PPS-VK	4-4(c), 4-6(c)	PVC/CPVC/PP	✓	×
	3”	3PPS-VK				
	4”	4PPS-VK				
Centrotherm – InnoFlue (Flush Mount)	2”	ISLPT0202		PVC/CPVC/PP	×	✓
	3”	ISLPT0303				
Centrotherm – InnoFlue Concentric (Wall)[9]	2”	ICWS2413 & ICTC0224	4-3(d), 4-5(d)	PVC/CPVC/PP	×	✓
	3”	ICWS3513 & ICTC0335				
		ICWT352 & ICTC0335				
	4”	ICWS4639 & ICTC0446				
Centrotherm – InnoFlue Concentric (Roof)[9]	2”	ICRT2439 & ICTC0224	4-4(c), 4-6(c)	PVC/CPVC/PP	✓	×
	3”	ICRT3539 & ICTC0335				
	4”	ICRT4679 & ICTC0446				

Notes:

[1] Instructions included with termination kits contain detailed assembly and installation instructions.

[2] All factory termination kits are ULC S636 approved.

[3] Clearance requirements in this manual supersede those of the instructions included with the vent terminal.

[4] Piping **MUST** be secured to the vent terminal during installation.

[5] IPEX Concentric Terminal **MUST** be cemented together and to the vent pipes during installation.

[6] Vent Screens provided with boiler may be used with the IPEX Concentric Vent Kits; otherwise use IPEX vent screens (2” vent screen P/N 196050; 3" vent screen P/N 196051; 4" vent screen P/N 196052 – each sold separately).

[7] IPEX Low Profile and Concentric kits (excluding P/N’s 197117 & 197021) are constructed out of ULC S636 approved **PVC**; check with your local authority for the acceptance of PVC as a venting material prior to use.

[8] IPEX Concentric kits can be shortened to fit the requirements of the installation; see instructions included with the kit for more details.

[9] Centrotherm Concentric termination kits must use the applicable “Twin pipe to concentric adapter,” part number ICTC0224, ICTC0335 or ICTC0446.

[10] 2” Vent Termination Kits may only be used with models Tft60-110; see Table 4-5.

[11] 3” Vent Termination Kits may only be used with models Tft60-250; see Table 4-5.

[12] 4” Vent Termination Kits may only be used with models Tft300-399; see Table 4-5.

IMPORTANT

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 Trinity Tft.

Sidewall Venting Options – Direct Vent Installation

Figure 4-3(a)

Two-pipe Termination (Sidewall)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)

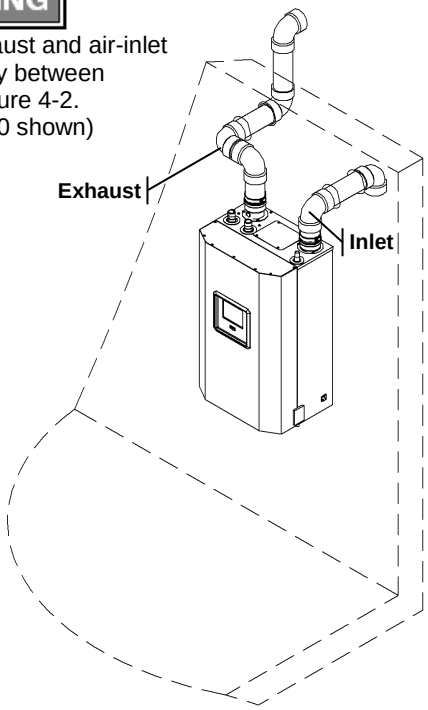


Figure 4-3(b)

Low Profile Termination (Sidewall)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)

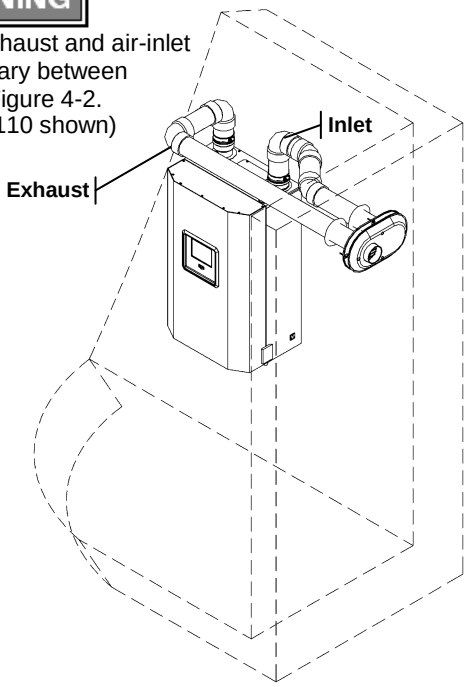


Figure 4-3(c)

IPEX Concentric Termination (Sidewall)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)

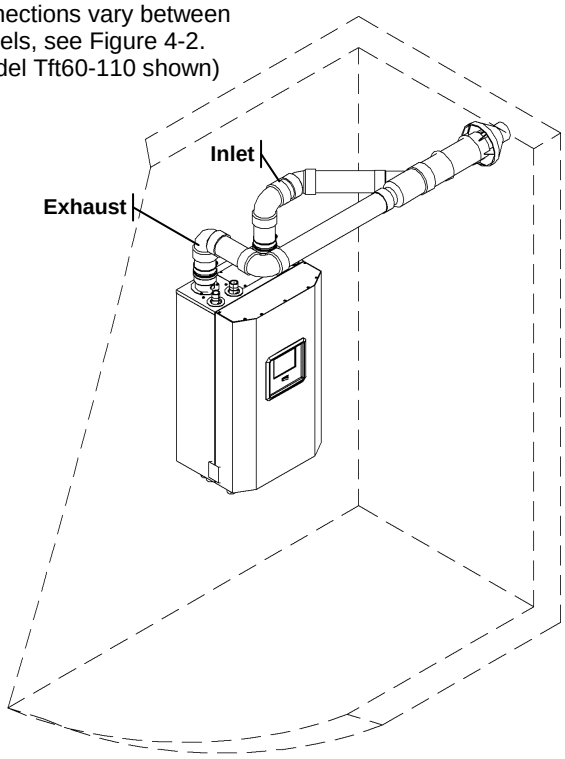
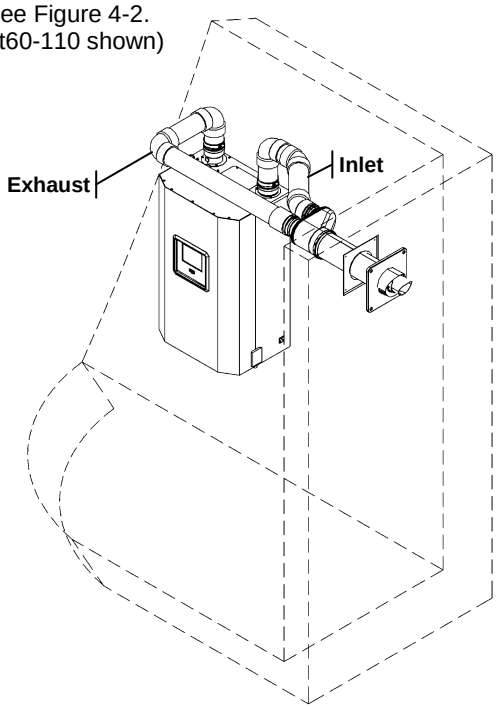


Figure 4-3(d)

PolyPro / InnoFlue Concentric Termination (Sidewall)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)



Roof Venting Options – Direct Vent Installation

Figure 4-4(a)

Two-pipe Termination (Roof)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)

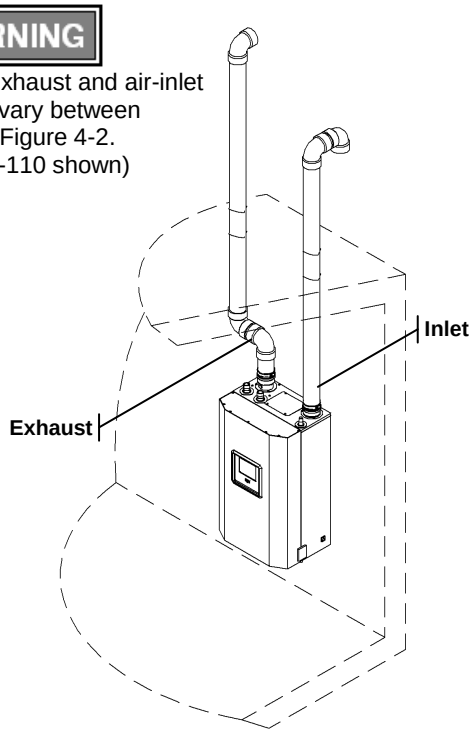


Figure 4-4(b)

IPEX Concentric Termination (Roof)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)

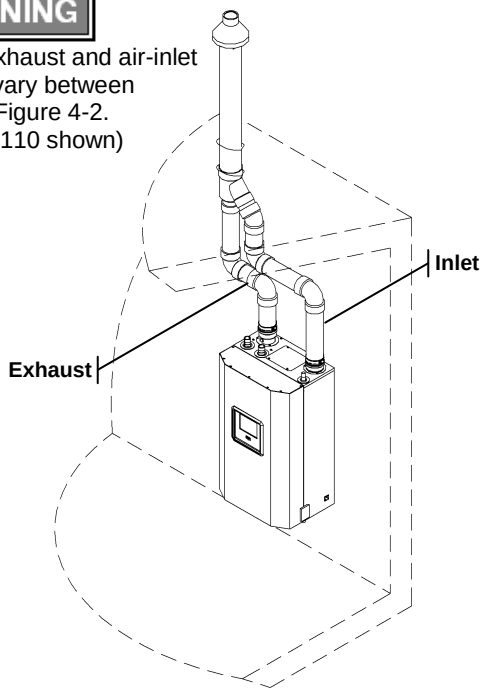


Figure 4-4(c)

PolyPro / InnoFlue Concentric Termination (Roof)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)

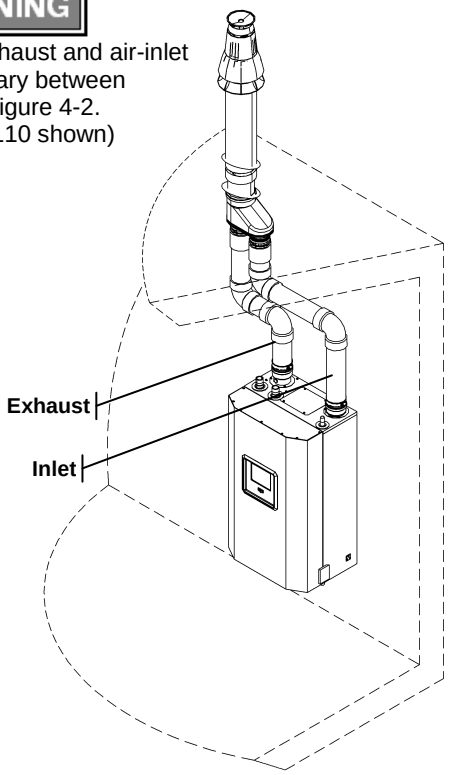
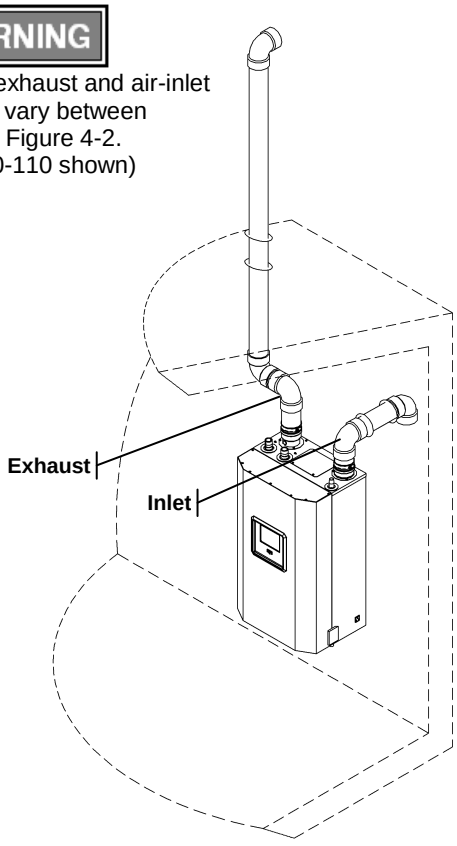


Figure 4-4(d)

Two-pipe Termination (Roof-exhaust / Sidewall-inlet)

⚠ WARNING

Location of exhaust and air-inlet connections vary between models, see Figure 4-2. (model Tft60-110 shown)



Sidewall Termination Details – Direct Vent Installation

Figure 4-5(a)

Two-Pipe Termination (Sidewall)

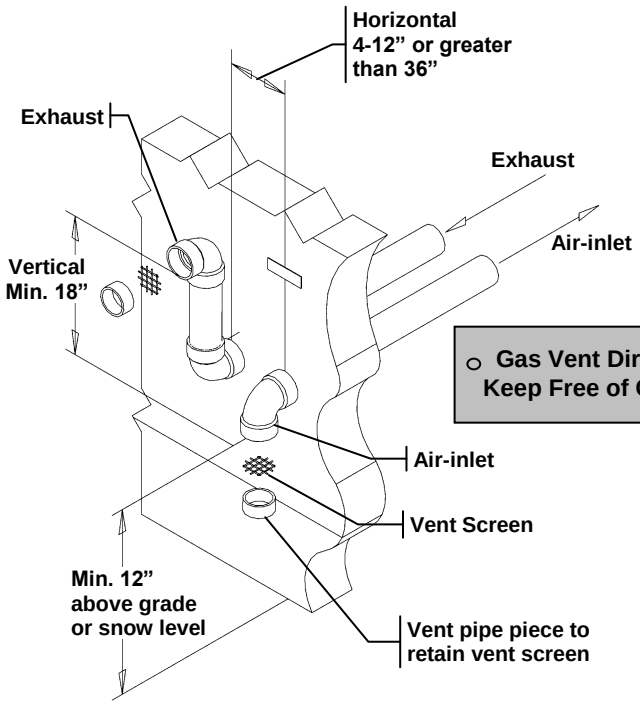


Figure 4-5(b)

IPEX Concentric Termination (Sidewall)

⚠ WARNING

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

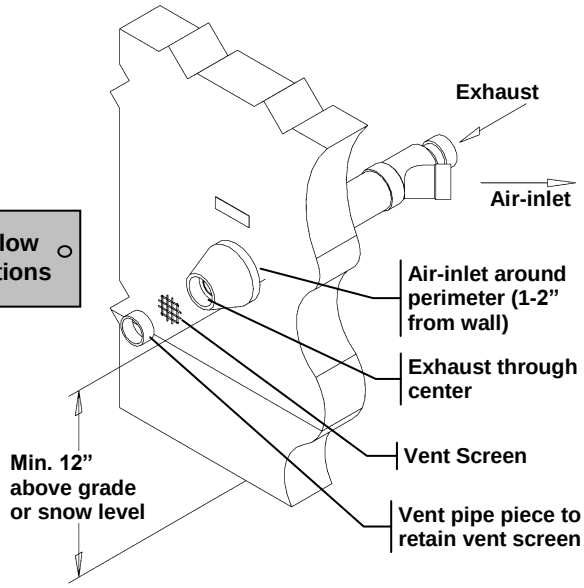


Figure 4-5(c)

IPEX Low Profile Termination

⚠ WARNING

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

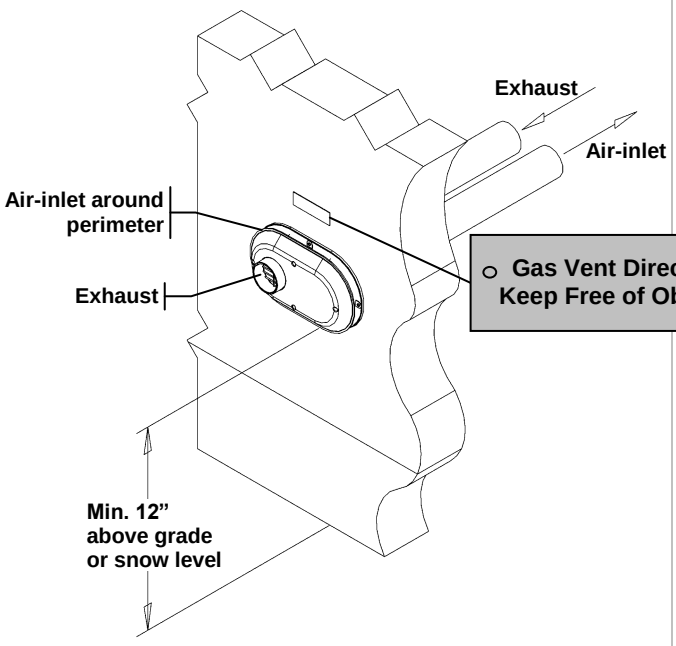
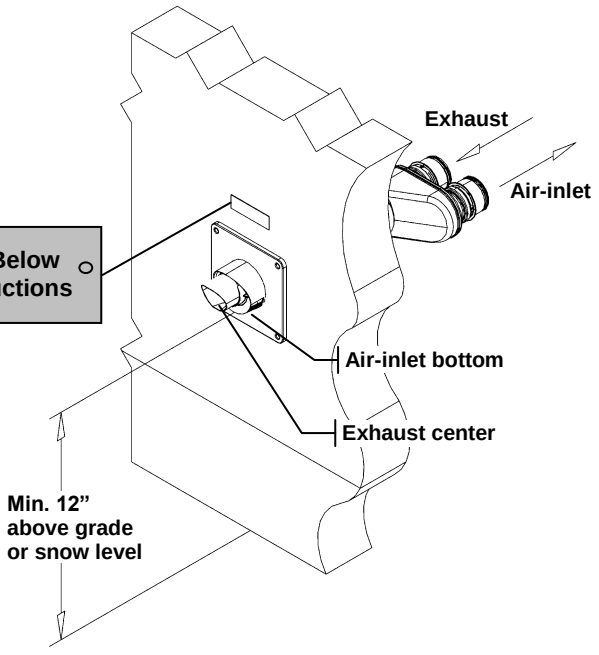


Figure 4-5(d)

DuraVent PolyPro Wall Termination

⚠ WARNING

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



Roof Termination Details – Direct Vent Installation

Figure 4-6(a)

Two-Pipe Termination (Roof)

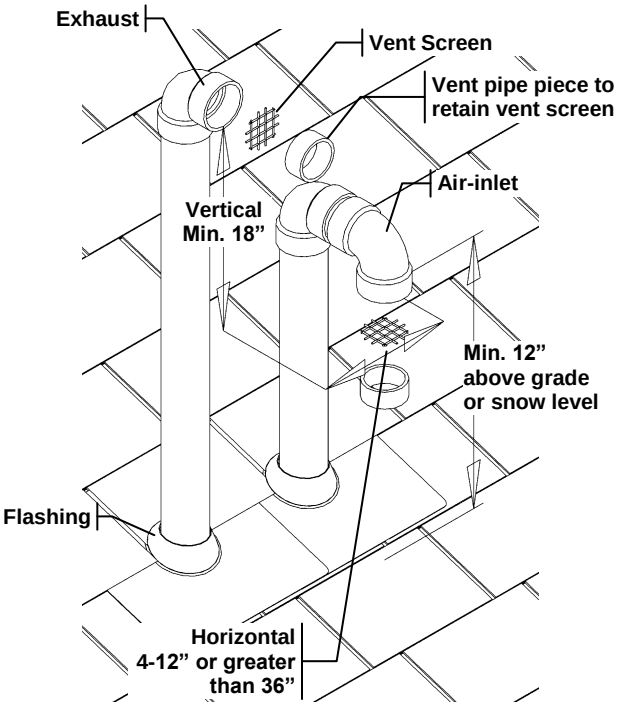


Figure 4-6(b)

IPEX Concentric Termination (Roof)

⚠ WARNING

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

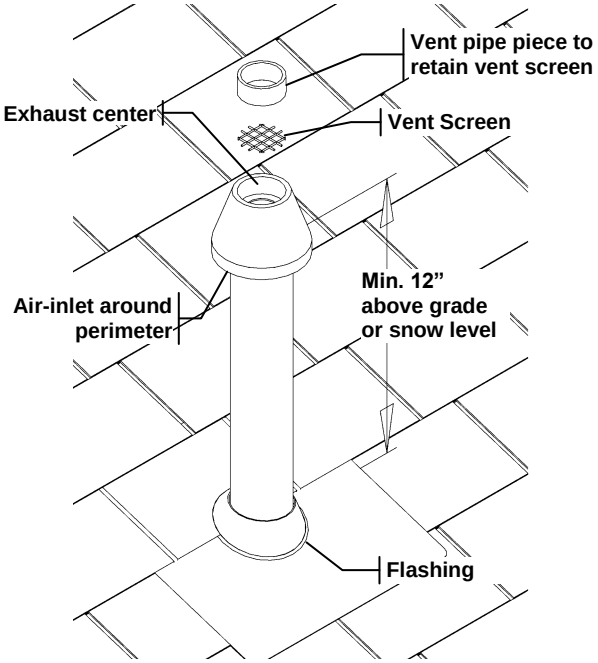


Figure 4-6(c)

DuraVent PolyPro Roof Termination

⚠ WARNING

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

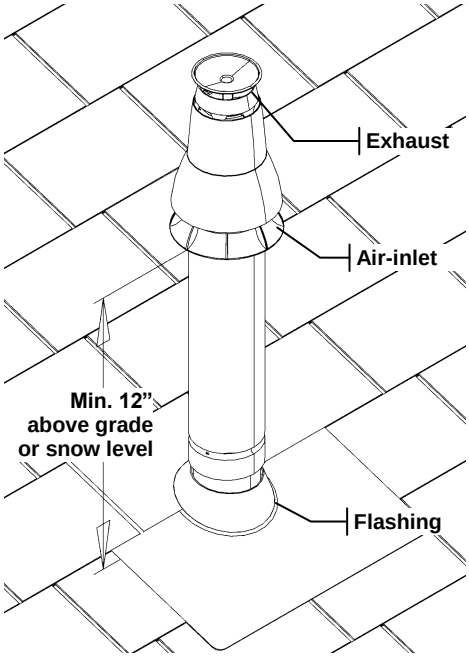
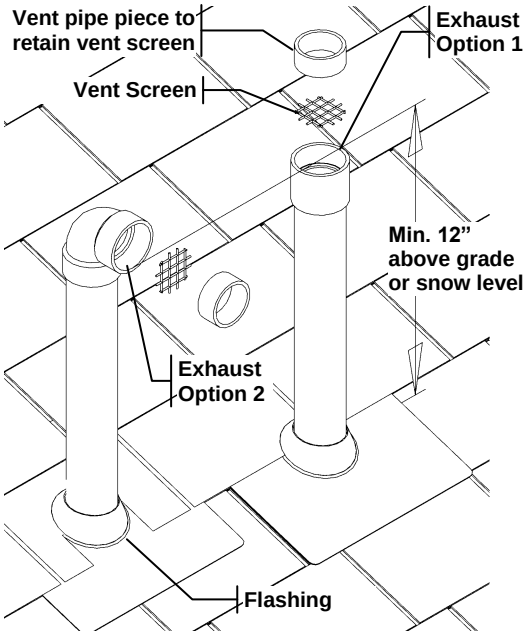


Figure 4-6(d)

Exhaust only Roof Termination

⚠ WARNING

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



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-inlet 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" [457 mm] above the air inlet, and the air inlet must always be a minimum of 12" [305 mm] plus snow allowance above any surface that will support snow. (Two feet plus snow allowance is highly recommended). Consult your weather office for the maximum typical snowfall for your region.
   E*xample*: 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" [102 mm] 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" [915 mm] 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 ½" [13 mm] away from the wall.
8. **Vent Sloping:** All indoor exhaust piping must be on a slope back to the boiler a minimum of ¼" per linear foot of vent [6.25 mm per linear 305 mm]. For applications where excessive condensation is possible ½" per linear foot [13 mm per linear 305 mm] is recommended.
9. **Vent Supports:** Where required Vent and Air-inlet piping shall be secured to the wall for more rigidity. All interior vent pipe shall be supported a minimum of every 36" [915 mm].
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 4-7.
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 4-5 and 4-6.
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", directly above (within 4 ft [1.22 m] vertically) the location of the air-inlet pipe, so it is visible from at least 8 ft [2.4 m] away. See Figure 4-5.
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" [25mm], Max.= 60" [1.52 m].
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 4-4 and 4-6 for roof top venting options.

Figure 4-7 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/Air-inlet piping MUST be secured to the side of the building above grade, as shown, to provide rigidity.
4. Optional mounting bracket PN. 82075 for securing the exhaust pipes (only applicable for 3" PVC/CPVC venting).
5. Ensure that the Vent/Air-inlet clearances are maintained, see Section 5.0 for details.

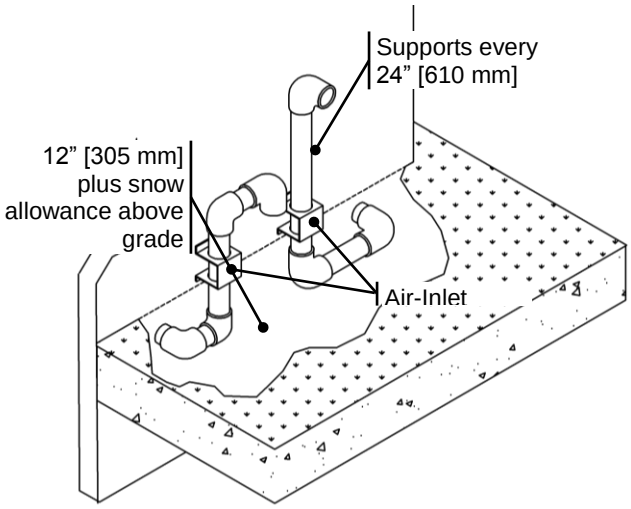


Figure 4-8 Outdoor Venting

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

1. The maximum length outside the building is 20 feet [6.1 m]. Note that outdoor length must be included in the overall vent length calculation.
2. All normal termination clearances are maintained.
3. The pipe is supported every 24" [610 mm].
4. The exhaust and air-inlet are sloped back to the boiler ½" elevation for every linear foot [13 mm for every linear 305 mm].

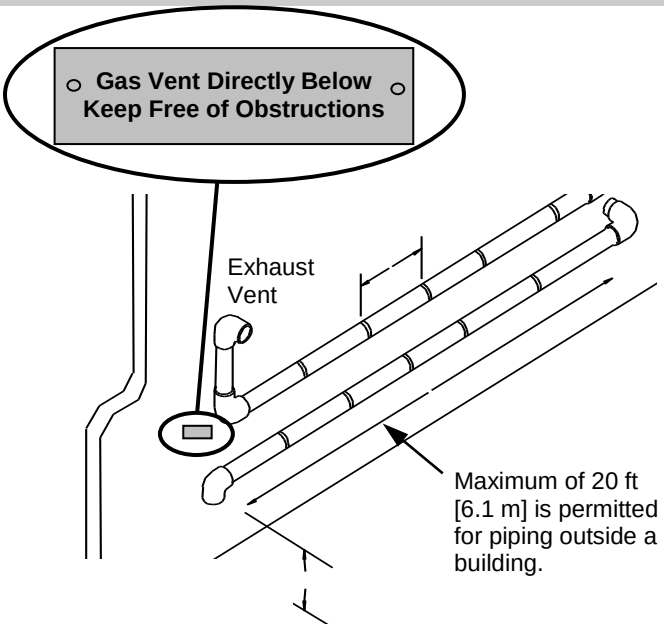
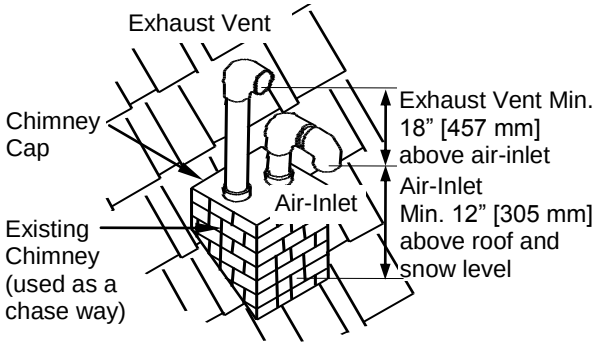


Figure 4-9 Existing Chimney Chase Way

It is permissible to use an existing chimney as a chase way to run the Vent/Air-inlet piping as long as:

1. The chimney is not being used by any other boiler.
2. Flue gases don't enter the vacant chimney.
3. Only Trinity certified venting materials are used, see Section 4.0.
4. Vent lengths are within the maximums specified.
5. The top of the chimney is capped and the Vent/Air-inlet pipes are flashed to prevent leakage into the vacant chimney.



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

5.0 VENT/AIR-INLET TERMINATION CLEARANCES

⚠ WARNING The quick reference table below is to be read in conjunction with the numbered notes as indicated, Figures 5-1 and 5-2, and the Venting Rules and Guidelines in Section 4.0. The instructions detailed in this section are a combination of Trinity Tft specific and National Gas Code restrictions. Compliance alone doesn't insure a satisfactory installation as good common sense must also be applied. Failure to follow these instructions may result in fire, property damage, serious injury or death.

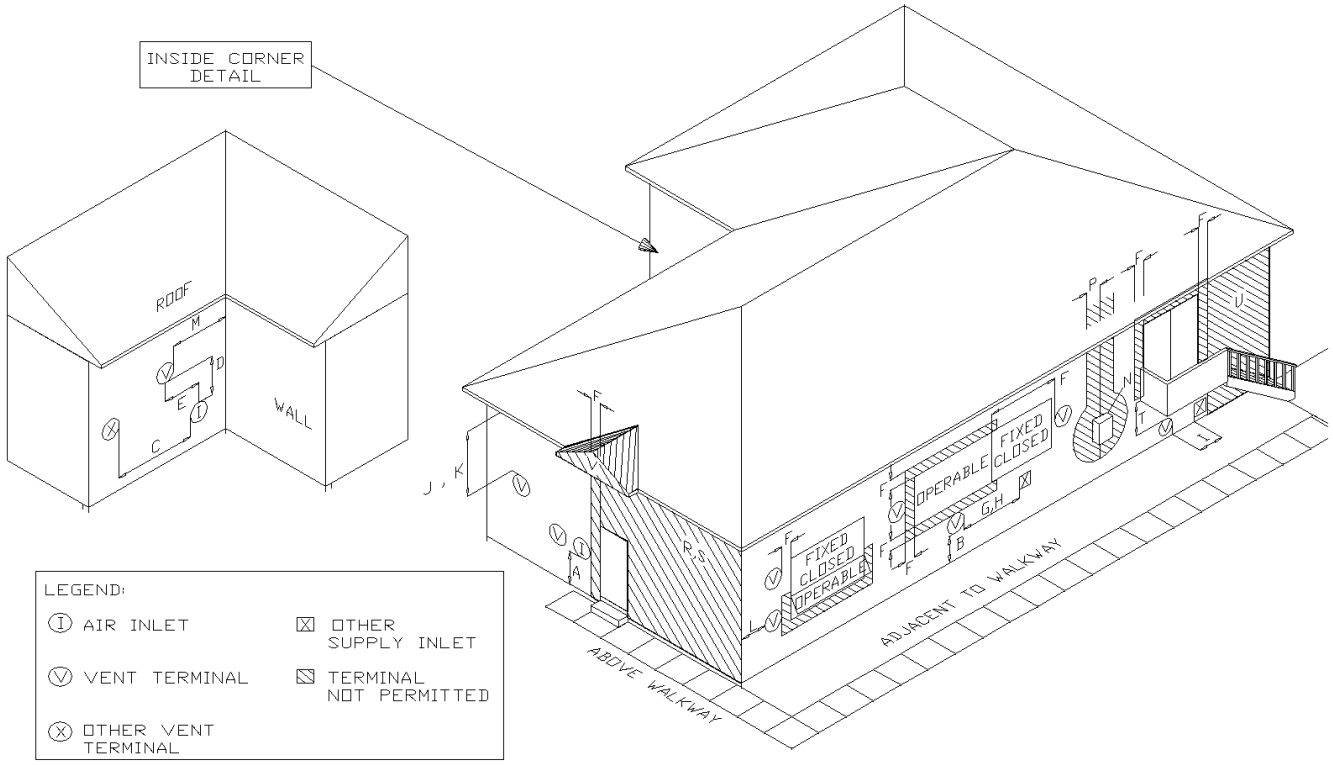
Table 5-1 Termination Clearances Quick Reference Table (See Figures 5-1 and 5-2)

Clearances to Air-Inlet Termination	**Canada** [1]		**USA** [2]	
	Min. Distance		**Min. Distance**	
A Above grade/roofline and snow level [8]	12 in.	305 mm	12 in.	305 mm
B Above roof line - Concentric Vent [6, 11, 13]	24 in.	610 mm	24 in.	610 mm
C To exhaust vent from any other boiler	36 in.	915 mm	12 in.	305 mm
Clearances to Exhaust Vent Termination	**Min. Distance**		**Min. Distance**	
A Above grade/roofline and snow level [8]	12 in.	305 mm	12 in.	305 mm
D Minimum vertical separation above air inlet [9]	18 in.	457 mm	18 in.	457 mm
E Minimum horizontal separation from air inlet [3]	4 in.	102 mm	4 in.	102 mm
F Window or door that may be opened, or other building opening	36 in.	915 mm	12 in.	305 mm
G To combustion air inlet of any other appliance	36 in.	915 mm	12 in.	305 mm
H Non-mechanical air supply inlet to building	36 in.	915 mm	12 in.	305 mm
I Mechanical air supply inlet to building [4]	6 ft.	1.83 m	3 ft.	915 mm
J Soffit, overhang, eave or parapet	24 in.	610 mm	24 in.	610 mm
K Soffit vent or vent opening in an overhang, eave or parapet	6 ft.	1.83 m	6 ft.	1.83 m
L Outside corner [10]	-	-	-	-
M Inside corner of an L-shaped structure (including walls and fences)	36 in.	915 mm	36 in.	915 mm
N Service regulator / vent outlet	36 in.	915 mm	36 in.	915 mm
P Each side of center line above or below meter / regulator assembly [5]	36 in.	915 mm	36 in.	915 mm
Q Above a paved sidewalk, driveway, or parking lot on public property if adjacent [12]	7 ft.	2.13 m	7 ft.	2.13 m
R Above a public walkway	x	x	x	x
S Above a sidewalk or paved driveway that is located between two single family dwellings and services both dwellings	x	x	x	x
T Under a concrete veranda, porch, deck, or balcony [7]	24 in.	610 mm	24 in.	610 mm
U Above, under or near exterior stairs	x	x	x	x
V Into a canopy or carport	x	x	x	x

Notes:

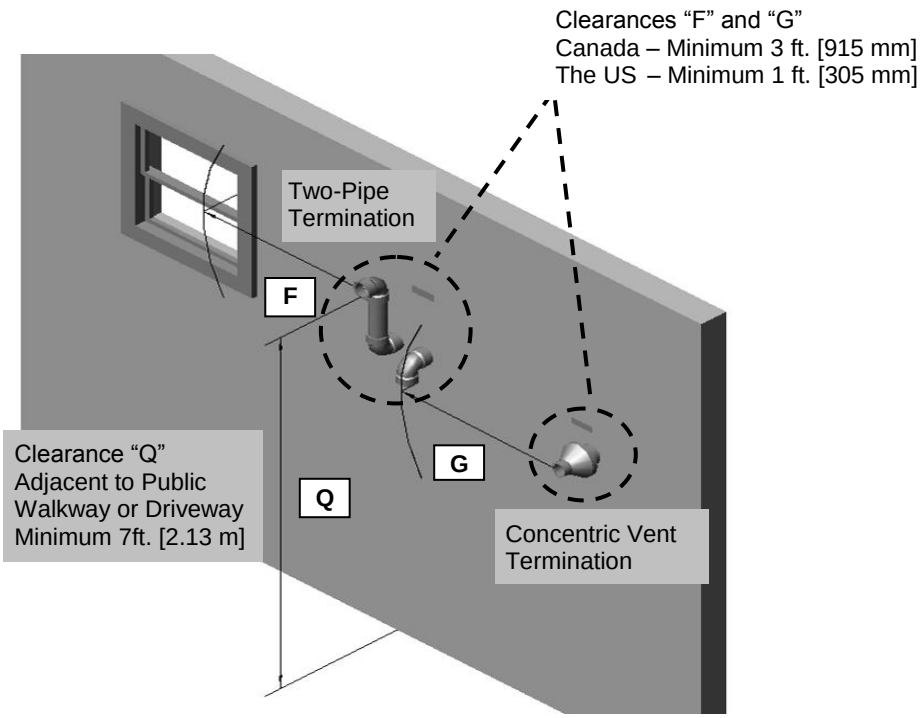
1 - Canadian installations must comply with the current CSA B149.1 Natural Gas and Propane Installation Code and local building codes.
2 - US installations must comply with current ANSI Z223.1/ NFPA 54 National Fuel Gas Code and local building codes.
3 - Horizontal separation center-to-center (c.c.) 4"-12" (102-305 mm).
4 - For US installations, an exhaust vent must be 3 ft above a mechanical air supply inlet if within 10 ft. [3 m] horizontally.
5 - Horizontal clearance must be observed up to a height of 15 ft. [4.6 m] above/below the meter, regulator, or relief devices.
6 - Concentric Vent must protrude from the roof precisely 24" [610 mm] measuring from the terminal end-cap vanes.
7 - Permitted if veranda, porch, deck, or balcony is made of concrete and a minimum of two sides are fully open beneath.
8 - 24" is the recommended snow level allowance above grade/roofline or any surface that will support snow, debris, or ice (i.e. for roof venting clearances - roofline and snow level). If living in a snowfall region, consult your local weather office for the maximum typical snowfall for your area.
9 - Note that the vent must maintain a minimum vertical distance above the air-inlet. Example: Vent height = 18" (457 mm) above air inlet + 12" (305 mm) for air inlet above grade/roof line and snow level = 30" (762 mm) above grade and snow level.
10 - Clearances to an outside corner to be in accordance with local installation codes.
11 - In Canada, concentric vent materials are subject to approval by local inspectors. See Termination Kits in Section 4.0.
12 - Above public walkways, driveways or parking lots if adjacent to it and condensate cannot drip, freeze, or create a hazard.
13 - Contact the manufacturer for special exemptions relating to multiple boiler installations using concentric vents.
x - Not permitted by National gas code(s) and/or recommended by boiler manufacturer.

Figure 5-1 Termination Clearance Quick Reference Diagram (See Table 5-1)



Illustrations of Termination Clearances

Figure 5-2 Sidewall Termination (See Table 5-1)



G – Letter represents a specific Termination Position. Refer to Table 5-1 for corresponding termination clearances.

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 notes that must be taken into consideration when constructing the condensate drain system (See Condensate Trap Installation Instructions for further details):

- **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.

Condensate Trap Installation Instructions (see Figure 6-1)

(Note: the Condensate Trap is factory supplied with the boiler and must be field installed)

1. **Inspect Condensate Trap Assembly** – Inspect the Condensate Trap to ensure all parts were shipped with the assembly (see Figure 6-1). The Condensate Trap must be periodically disassembled and cleaned as part of a regular maintenance plan.
2. **Attach to Boiler Condensate Drain** – Insert the inlet fitting of the Condensate Trap into the boiler condensate drain; secure with the factory supplied gear clamp (see Figure 6-1). Pull down on the Condensate Trap and ensure that it remains securely fastened.
3. **Outlet to Drain** – Direct condensate from the outlet of the Condensate Trap to a household drain, condensate pump or neutralizer (check with your local authority regarding the disposal of condensate). If necessary connect suitable ¾" tubing to the bottom of the Condensate Trap and route it to drain, being careful NOT to route it higher than the Condensate Trap outlet (see Figure 6-1).

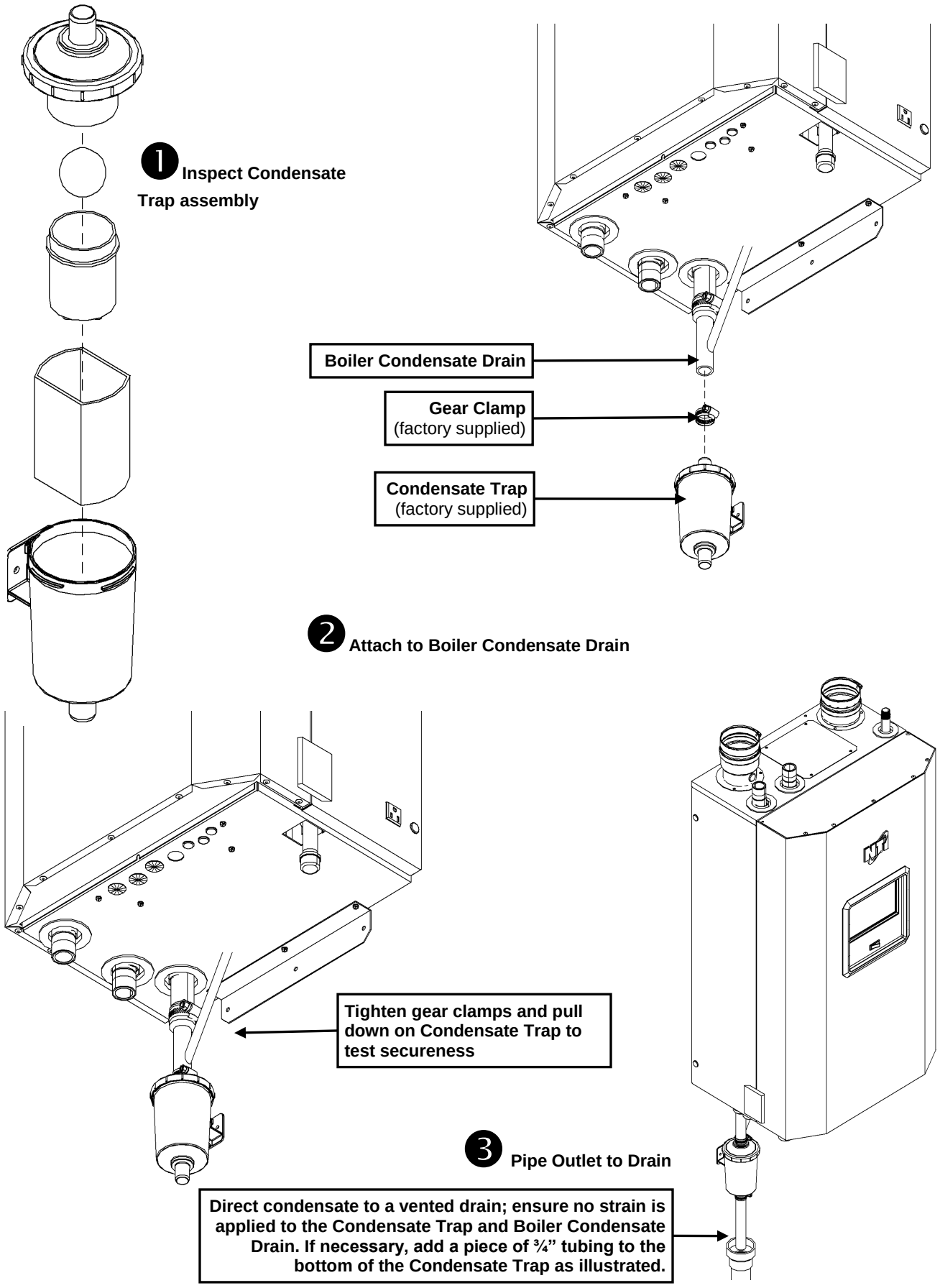
⚠ CAUTION

The Condensate Trap 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.

⚠ DANGER

Carefully follow the above instructions and the accompanying figure – check to ensure the condensate trap is secure to the bottom of the boiler and that no strain is placed on it. Failure to install the condensate trap properly will result in flue gas spillage and leeching of carbon monoxide emissions into the surroundings resulting in serious injury or death.

Figure 6-1 Condensate Drain Piping



7.0 INSTALLING GAS PIPING

⚠ WARNING The Trinity Tft is factory equipped to operate with Natural Gas, the installation of a conversion kit is required prior to operating with Propane Gas. The Natural to LP Conversion Kit (see Table 7-1) must be installed prior to installing the gas piping to the boiler. Failure to properly convert the unit to operate with Propane may result in property damage, serious injury or death.

⚠ WARNING 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.

Table 7-1 Natural to LP Propane Conversion Kit

Model	Kit Number	Orifice Number
Tft60-85	82650-1	415 (4.15mm)
Tft110	82650-1	52 (5.2mm)
Tft155-250	82650-1	62 (6.2mm)
Tft300-399	84471-1	74 (7.4mm)

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:

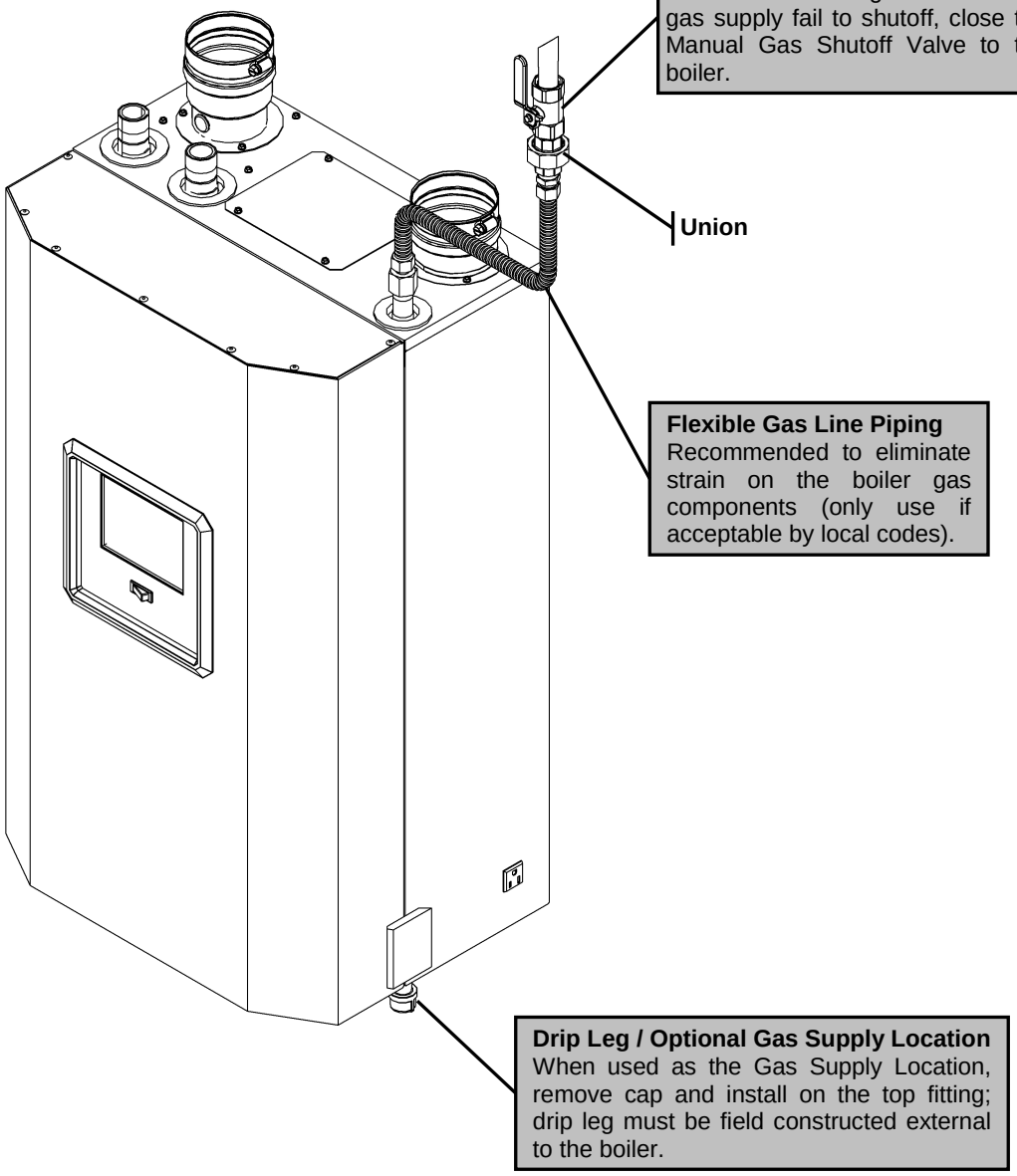
- The gas line connection to the boiler does not apply any weight to the gas valve. NTI recommends using approved flexible gas piping (if acceptable by local codes) to connect the boiler to the gas supply (See Figure 7-1 for details).
- You plan the installation so the piping does not interfere with 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.

⚠ WARNING 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.

⚠ WARNING 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.

⚠ WARNING 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" w.c.), as damage to the gas valve could occur resulting in fire, property damage, serious injury or death.

Figure 7-1 Gas Line Connection (Typical)



⚠ WARNING 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

⚠ DANGER Before Start-up refer to **Mandatory Pre-commissioning Procedure for Plastic Venting** in Section 4.0. Failure to follow these instructions can result in explosions, injury or death.

⚠ DANGER 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 Vent/Air-Inlet, 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.

⚠ WARNING 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.

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

⚠ WARNING Should overheating occur or the gas supply fail 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

⚠ WARNING 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 completely filled with water, and that ALL the air is purged out.

⚠ DANGER 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 4.0. Failure to follow these instructions can result in explosion, serious injury or death.

Initial Start-Up

1. Turn on power to the Trinity Tft 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 at least three times, before locking-out.)
2. With the unit operating at full capacity, verify that the gas line pressure is 4-10.5 inches w.c. for Natural gas, and 9-13 inches w.c. for Propane (See Section 9.0 for details).
3. Using an appropriate Oxygen (O_2) or Carbon Dioxide (CO_2) analyzer, take a sample of the flue gas. The sample must fall within the acceptable ranges for CO_2, which is 8.7% - 9.7% for Natural Gas, and 10.5%-11.5% for Propane (See Section 9.0 for details).
4. Perform at least three lights in succession to ensure proper operation.
5. After the three successive lights, unplug the flame probe, and allow the unit to cycle again. The flame safety system will allow the unit to go through 4 ignition cycles before going to "Hold 110 – Ignition failure occurred". Once you have confirmed this behavior, replace the wire on the flame sensor, recycle power and reconfirm proper lighting.

⚠ WARNING The flame probe is located in the burner plate; it has a single white/semi-transparent wire connected to it. DO NOT remove the orange 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.

⚠ WARNING 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 don't 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

⚠ WARNING Set-up of the Trinity Tft 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.

Gas Line Pressure

The boiler gas valve is equipped with a line pressure test port; see Figures 9-1 and 9-2. 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 9-1 and 9-2.
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 to the maximum firing rate (See Table 9-2) 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 the "Nominal/Desired" value listed in Table 9-1, while the unit is operating at the maximum modulation rate, see Table 9-2.
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.

NOTICE 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.

⚠ DANGER 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 Line Pressure and Combustion Parameters

Gas	Line Pressure (inches wc)			CO_2 (%)*		CO (ppm) Max.*
	Nominal/Desired	Min.	Max.	Min.	Max.	
Natural	7	4	10.5	8.7	9.9	175
Propane	11	8	13	10	11.5	175

*Note: Observe the combustion products with the burner operating at the maximum modulation rate.

Table 9-2 Minimum and Maximum Modulation Rates

Model	Min. Modulation Rate (RPM)	Max. Modulation Rate (RPM)
Tft60	1525	4650
Tft85	1525	6300
Tft110	1625	7000
Tft155	900	3700
Tft175	900	4100
Tft200	900	4650
Tft250	900	5900
Tft300	1500	5000
Tft399	1500	6900

⚠ WARNING

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

⚠ WARNING

Manifold Pressure - DO NOT adjust or measure the Manifold Pressure of the boiler. Correct manifold pressure is factory set. Field adjustment could result in improper burner operation resulting in fire, explosion, property damage or death.

⚠ WARNING

Adjustments to the Throttle / Input Screw may only be made by a qualified gas technician, while using a calibrated combustion analyzer capable of measuring CO_2 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.

Throttle/Input Adjustment Screw

Decrease gas
Turn Clockwise

Increase gas
Turn Counter Clockwise

Adjustment

Throttle / Input Screw Adjustments - The boiler is equipped with a Throttle/Input Adjustment Screw, located on the Gas Valve and Venturi Assembly. It is used to adjust the flow of gas leaving the gas valve entering the Venturi and then the combustion air stream. Turn the adjustment screw in (clockwise) to reduce the flow of gas, make combustion leaner, and reduce the concentration of CO_2 in the flue gases. To increase the CO_2 level and flow of gas in the combustion air stream, adjust the Throttle screw out (counterclockwise).

Tft60-250 Adjustments - The throttle screw for models Tft60-250 is a multiple turn valve. Typical adjustment required for Natural Gas is 0-1 full turns in or out from the factory setting. Typical adjustment for LP Gas is 0-3 full turns in or out from the factory setting upon inserting the LP orifice as per the applicable Propane conversion instructions. See Figure 9-1 for throttle screw location.

Tft300-399 Adjustments - The throttle screw for the Tft300-399 is a geared valve with a 4:1 ratio. Adjusting the throttle screw 4 complete turns will return the valve to the original location, 2 turns from fully open will completely close the valve. Typical adjustment required is 0-1/4 turn in or out from the factory setting. See Figure 9-2 for throttle screw location.

Combustion Calibration - To calibrate burner operation, perform the following procedure using a calibrated combustion analyzer capable of measuring CO_2 and CO from Natural and Propane Gas burning boilers:

1. Operate the unit at the maximum modulation rate, see Table 9-2.
2. Ensure the gas line pressure is maintained within tolerance, see Table 9-1.
3. While at the maximum modulation rate, measure the CO_2 and CO; adjust as necessary, using the Throttle Screw, to be within the limits listed in Table 9-1.
4. Operate the unit at the minimum modulation rate (Table 9-2). Ensure the combustion remains smooth and CO_2 and CO remain within the limits (Table 9-1). If not, do not adjust further, contact NTI for assistance.

Flue Gas Analysis and Adjustment

Each Trinity Tft is factory set to operate with Natural Gas, for boilers field converted to operate with Propane Gas, a flue gas analysis and adjustment is mandatory. See Table 7-1 and Propane conversion instructions.

⚠ WARNING

Failure to perform the flue gas analysis and adjustment detailed in this section may result in erratic and unreliable burner operation, leading to reduced efficiency, increased fuel consumption, reduced component life, heat exchanger combustion deposits, and general unsafe operation. Failure to follow these instructions may result in serious injury or death.

Analysis – Perform flue gas analysis, and adjust throttle/input screw as required until CO_2 and CO levels are within acceptable limits.

Figure 9-1 Tft60-250 Gas Valve and Venturi Assembly

(model Tft60-110 shown)

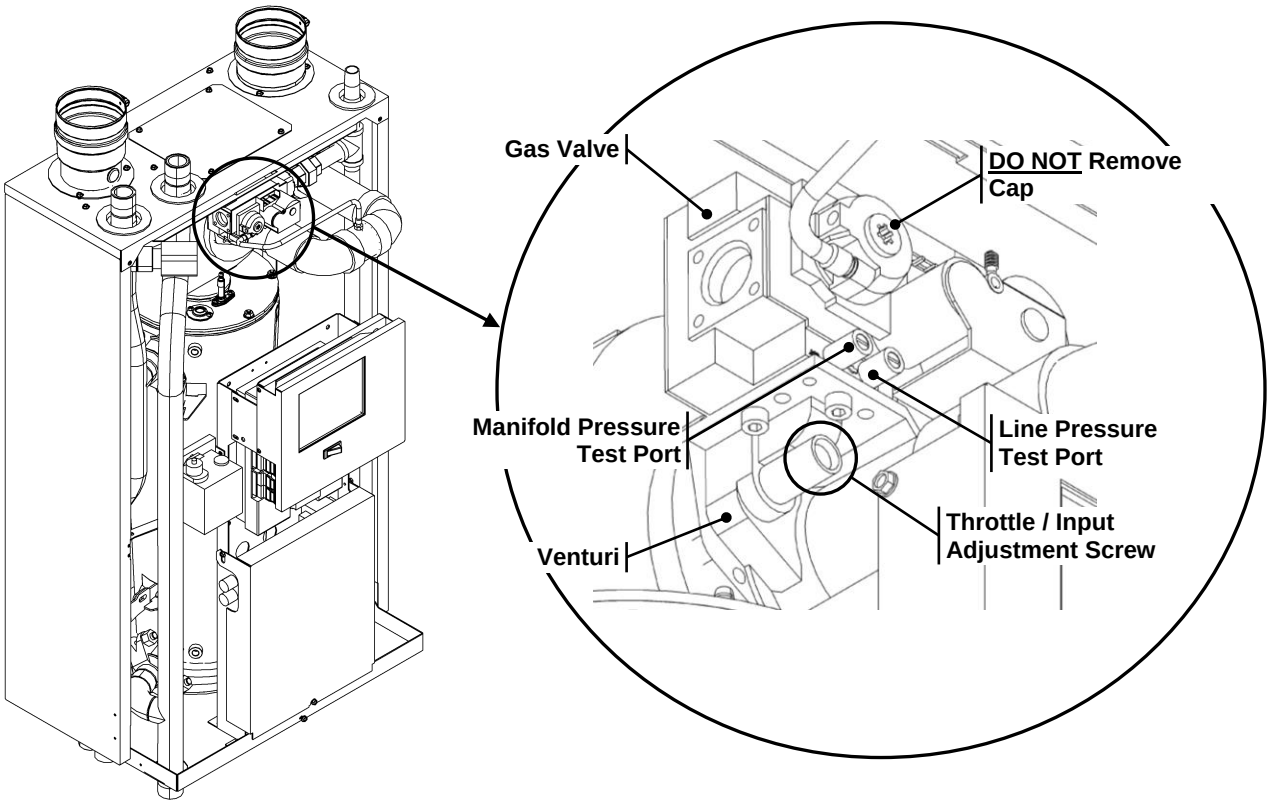
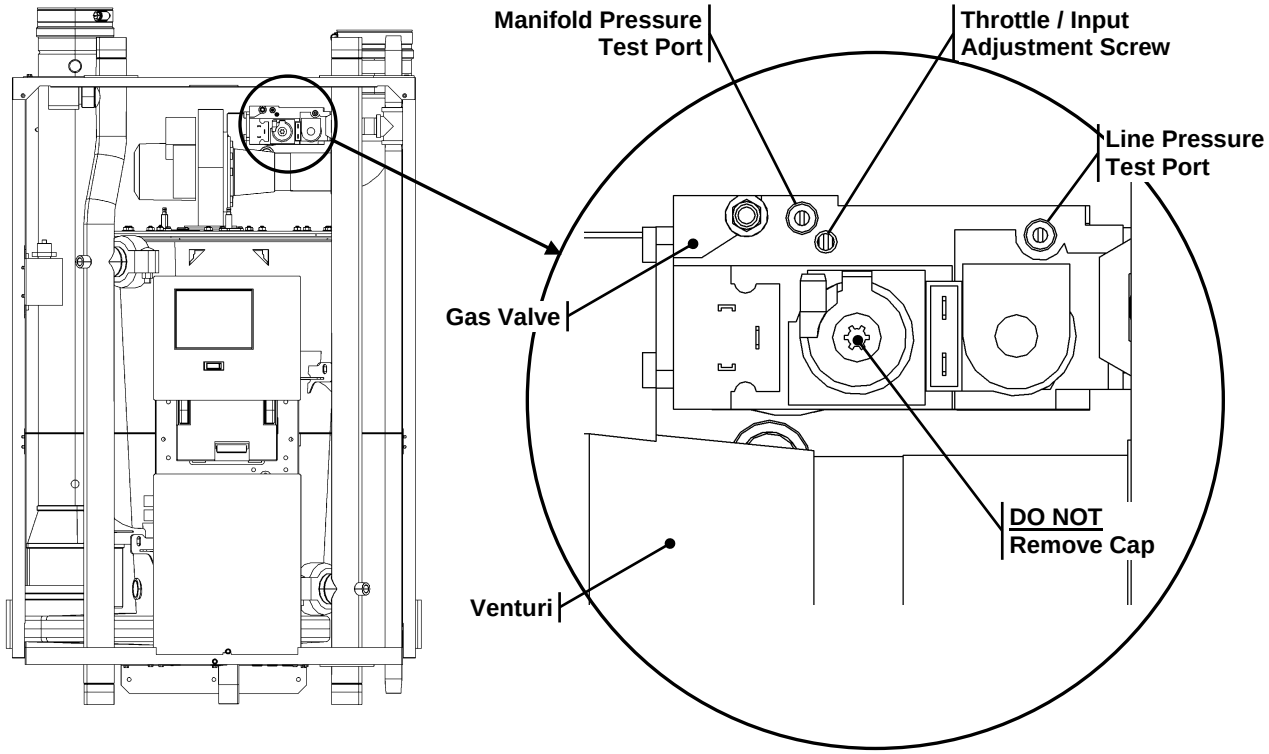


Figure 9-2 Tft300-399 Gas Valve and Venturi Assembly



10.0 BOILER AND HEATING SYSTEM PIPING

The fire tube design of the Trinity Tft heat exchanger results in minimal head loss, however it must be considered when sizing system piping and circulators. Furthermore, the low mass of the Tft heat exchanger requires a minimum flow rate anytime the burner is operating. To maintain the 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.

Boiler System Preparation

Prior to connecting plumbing to the boiler, flush the entire system to ensure it is free of sediment, flux, solder, scale, debris or other impurities that may be harmful to the system and boiler. During the assembly of the heating system, it is important to keep the inside of the piping free of any debris including construction and copper dust, sand and dirt.

For retrofits, all system piping, including radiators, must be cleansed of build-up including sludge and scale. All systems, old and new, must be cleansed to remove flux, grease and carbon residue; NTI recommends cleaning the boiler system with "Fernox F3 Cleaner". For retrofit applications with heavy limescale and sludge deposits, a heavier duty cleaner may be required; NTI recommends the use of "Fernox DS-40 System Cleaner". For information on performing the cleaning, follow the instructions included with the applicable Fernox Cleaner. See Table 10-1 for a list of recommended boiler system cleaning and treatment products.

CAUTION Failure to rid the heating system of the contaminants listed above will void your NTI warranty and may result in premature heat exchanger failure and property damage.

Table 10-1 Boiler System Cleansers and Corrosion Inhibitors

Application	Fernox Product	NTI Part #	Description
Boiler Water Treatment	F1 Protector	83448	Corrosion inhibitor.
Cleanser for new and old systems	F3 Cleaner	83449	Removes flux, grease and carbon residue.
Cleanser for Retrofits	DS-40 System Cleaner	83450	Removes heavy limescale and sludge deposits.

Boiler Water

Pressure - Trinity boilers are intended solely for use in pressurized closed-loop heating systems operating with a minimum pressure of 15 PSI at the boiler outlet. To obtain the minimum system design pressure, follow the piping diagrams illustrated in this section.

Oxygen Elimination - This boiler may only be installed in a pressurized closed-loop heating system, free of air and other impurities. To avoid the presence of oxygen, ensure all of the air is removed from the system during commissioning via strategically placed, adequately sized air-removal devices; located throughout the heating system. See figures in this section detailing the location of the primary air-removal device required for the boiler. Immediately repair any leaks in the system plumbing to avoid the addition of make-up water; make-up water provides a source of oxygen and minerals that may lead to heat exchanger failure. Failure to follow these instructions will result in poor performance, unnecessary wear of system components and premature failure.

NOTICE The Trinity Tft 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.

Water Chemistry – The installer of the Trinity Tft boiler must consider the condition of the water in the heating system. Ensure the condition of the boiler water falls within the following parameters:

- PH – between 6.6 and 8.5.
- Chloride – less than 125mg/l.
- Conductivity – less than 400µS/cm (at 25ºC); [TDS < 200ppm or Total Hardness < 11.6grains/USgal.]
- Iron – less than 0.5mg/l.
- Copper – less than 0.1mg/l.

Treatment - Boiler water that falls outside of the conditions listed above must be treated with a corrosion inhibitor. For information on performing the treatment, follow the instructions included with the corrosion inhibitor. See Table 10-1 for a list of recommended boiler system cleaners and corrosion inhibitors.

IMPORTANT To maintain protection, the level of corrosion inhibitor must be monitored periodically for the correct concentration.

Anti-freeze - For systems requiring freeze protection, use only inhibited propylene glycol, specially formulated for hydronic heating systems; use of other types of antifreeze may be harmful to the system and will void the warranty. 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. NTI recommends against exceeding 35% concentration of glycol.

CAUTION DO NOT use inhibited glycol with non-compatible boiler inhibitors. Non-compatible inhibitors may counteract each other rendering them ineffective.

Near Boiler Plumbing

Pressure Relief Valve - A Pressure Relief Valve is factory supplied with each unit. Trinity Tft boilers have a maximum allowable operating pressure of 30PSI (80PSI for models Tft155-399). The pressure relief valve must be installed at the boiler outlet and in the vertical position, as shown in Figures 10-1 through 10-3, with the drain pipe outlet exiting the side of the pressure relief valve horizontally and elbowing downward.

⚠ CAUTION If installed in the incorrect orientation (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 Gauge – Trinity Tft units come with a factory supplied Pressure Gauge. The pressure gauge must be installed at the boiler outlet prior to any circulators. See Figures 10-1 through 10-3.

Auto Air Vent – Install the factory supplied auto air vent directly above the outlet fitting on the top of the unit; see Figures 10-1 through 10-3 illustrating the correct location. Failure to install the auto air vent as illustrated may result in occasional malfunctioning of the incorporated LWCO.

Low Water Cutoff (LWCO) – Trinity Tft 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 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 "Lockout 67 ILK OFF" 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. Clear the Lockout from the display board; burner should fire.
3. With the burner firing, press the TEST 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.
- Every 5-years – Remove the LWCO and clean all surfaces in contact with water.

Near Boiler Piping (Tft60-110)

Figure 10-1(a)

Supply/Return Bottom (Tft60-110)

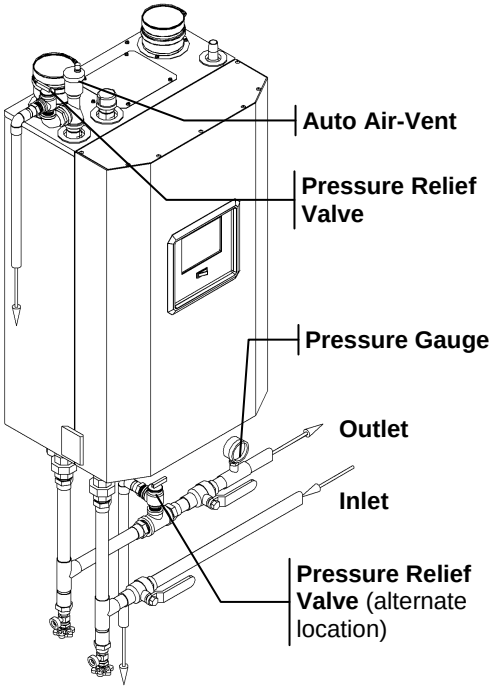


Figure 10-1(b)

Supply/Return Top (Tft60-110)

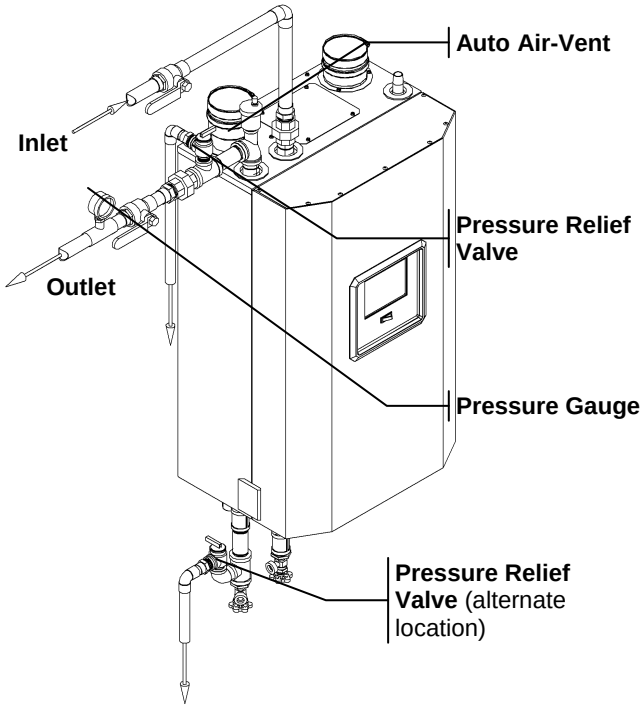


Figure 10-1(c)

Supply Top / Return Bottom (Tft60-110)

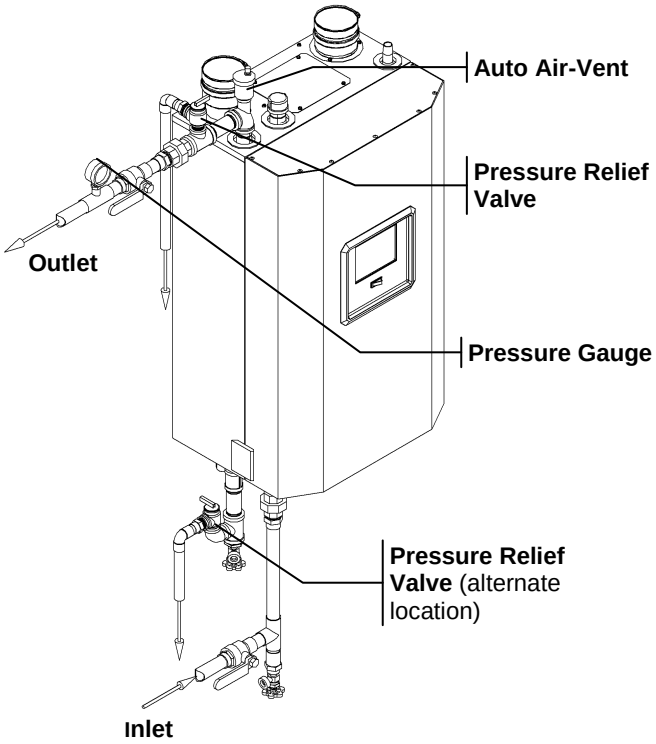
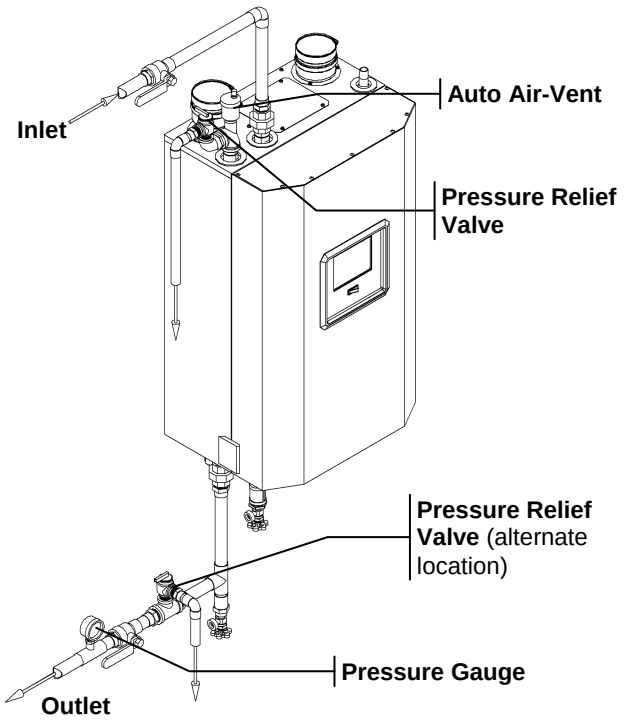


Figure 10-1(d)

Supply Bottom / Return Top (Tft60-110)



Near Boiler Piping (Tft155-250)

Figure 10-2(a)

Supply/Return Bottom (Tft155-250)

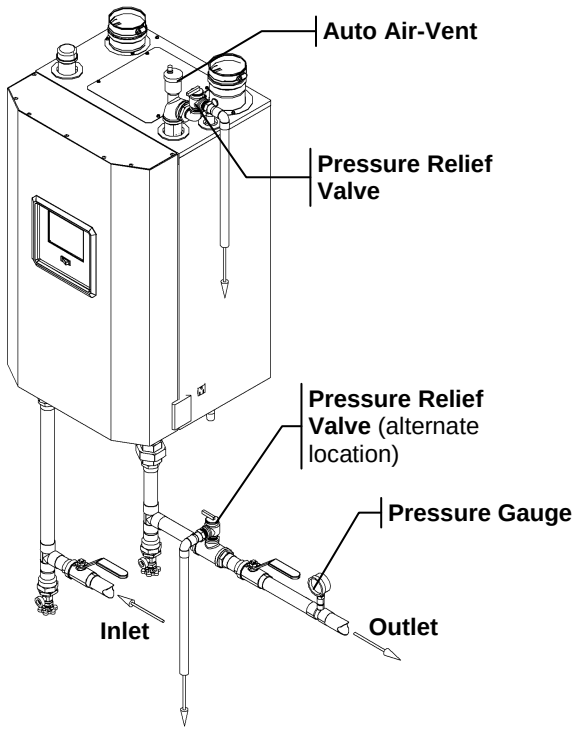


Figure 10-2(b)

Supply/Return Top (Tft155-250)

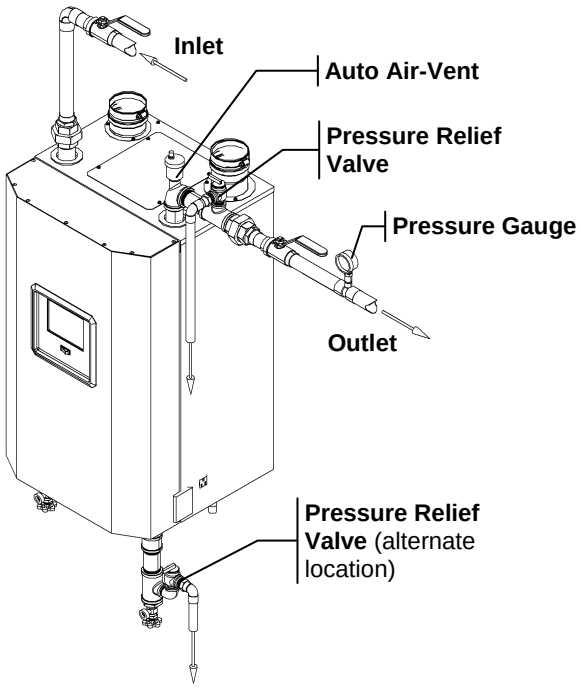


Figure 10-2(c)

Supply Top / Return Bottom (Tft155-250)

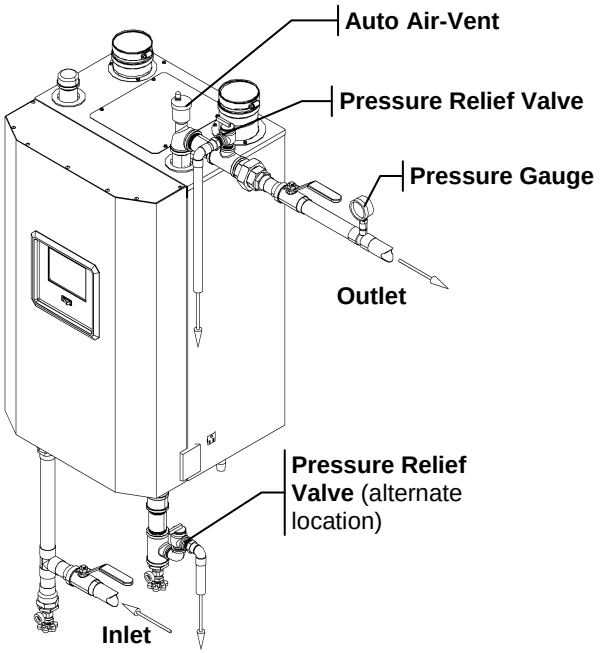
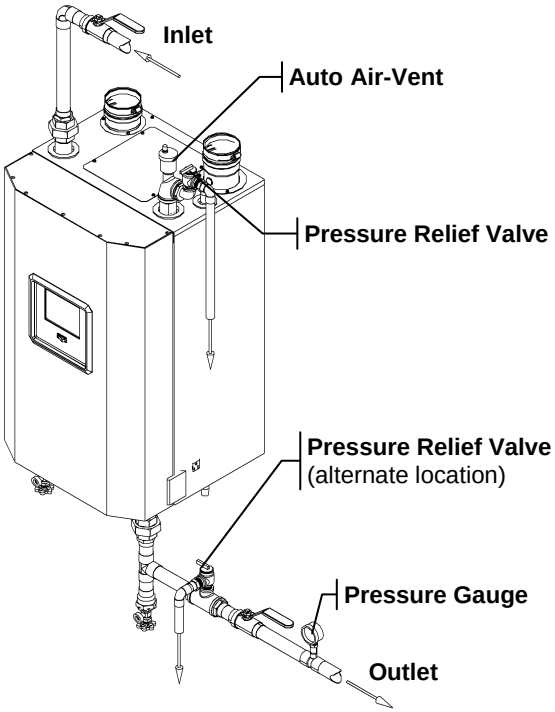


Figure 10-2(d)

Supply Bottom / Return Top (Tft155-250)



Near Boiler Piping (Tft300-399)

Figure 10-3(a)

Supply/Return Bottom (Tft300-399)

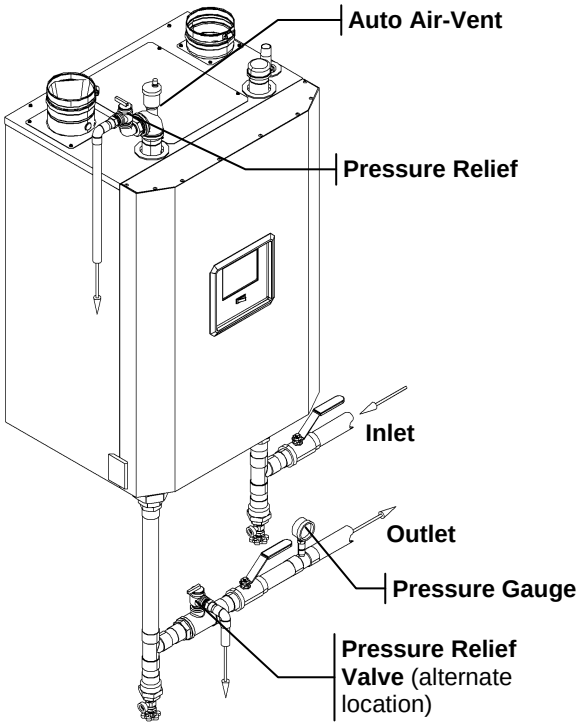


Figure 10-3(b)

Supply/Return Top (Tft300-399)

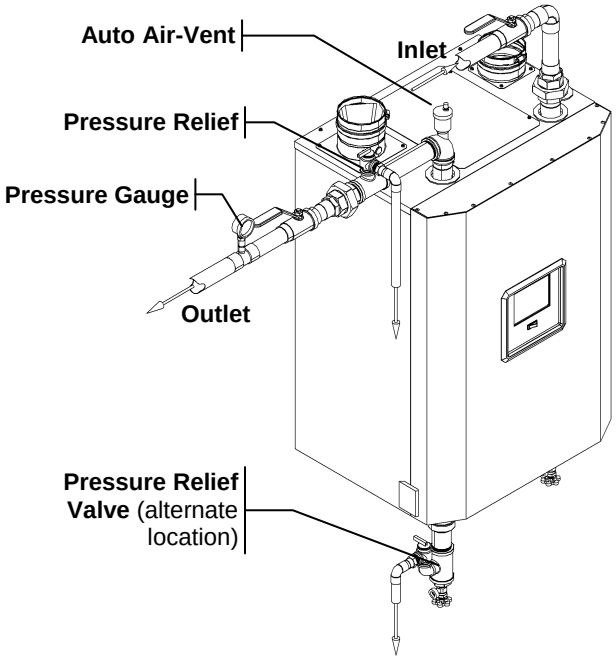


Figure 10-3(c)

Supply Top / Return Bottom (Tft300-399)

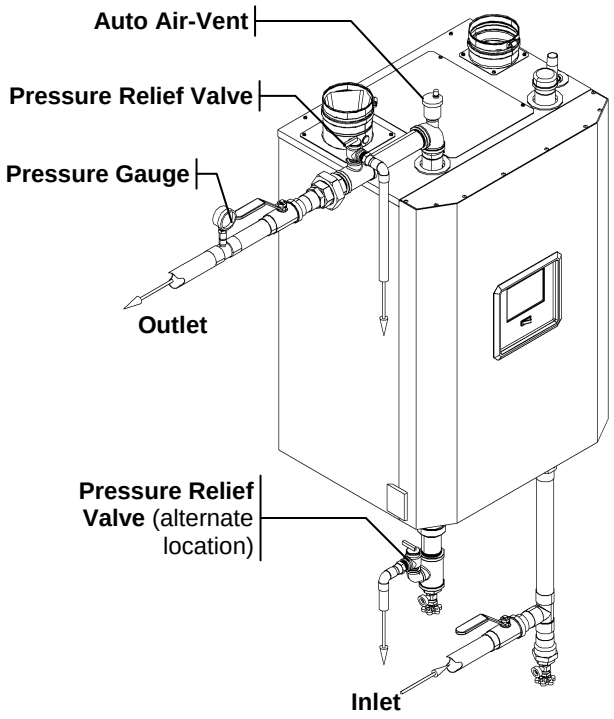
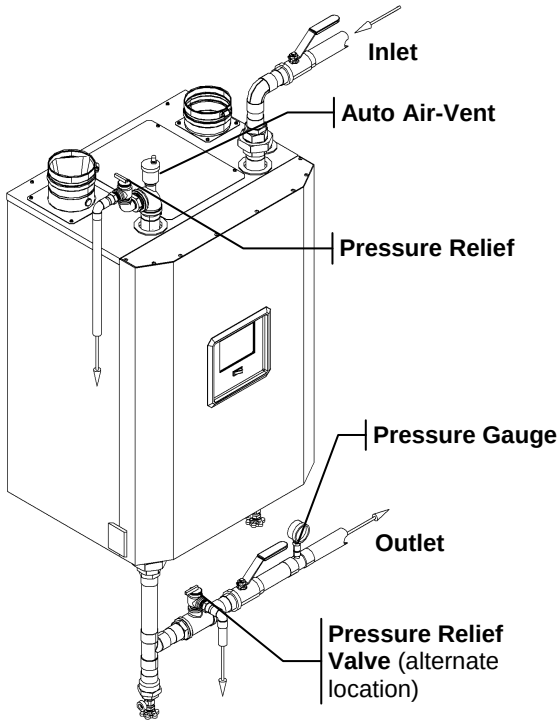


Figure 10-3(d)

Supply Bottom / Return Top (Tft300-399)



Boiler System Plumbing

The Trinity Tft 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 10-5 and 10-6.

Table 10-2 Minimum Flow Rate Requirements

Model	Flow (US gpm)
Tft60	3
Tft85-110	3.5

Model	Flow (US gpm)
Tft155-250	7.5
Tft300-399	12

System Components – As a minimum, a properly installed system will include the following major components identified in Table 10-3.

Table 10-3 System Major Component Checklist

Factory Supplied	Field Supplied Components
☐ Pressure Relief Valve	☐ Boiler Loop Circulator (Pump B in Figure 10-5 or Pump C in Figure 10-6)
☐ Pressure Gauge	☐ DHW Loop Circulator (Pump A in Figure 10-5 and Figure 10-6, for applications utilizing and Indirect Fired Water Heater)
☐ Auto Air Vent	☐ Central Heat (CH) Loop Circulator(s) (CH Circulator - Pump C in Figure 10-5; Zone Circulators in Figure 10-6)
	☐ Central Air Removal Devices (i.e. Micro Bubbler or Air-Scoop)
	☐ Pressure Regulating "Fill Valve"
	☐ Backflow Preventer
	☐ Expansion Tank

Circulating Pumps – Trinity Tft boilers are equipped with three 120VAC pump outputs:

1. PUMP A "DHW Pump" - operates during a Domestic Hot Water demand (DHW).
2. PUMP B "Boiler Pump" - operates during any demand.
3. PUMP C "CH Pump" - operates during a Central Heat/Thermostat demand (THERMOSTAT).

Ensure pumps are oriented as per the manufacturers' instructions. Wiring of these circulators will depend on the system configuration selected; see Figures 10-5 and 10-6. For further wiring details see Section 12.0.

NOTICE

Circulators responsible for forcing the water flow through the boiler must be sized according to Table 10-4. Pump recommendations are based on a Primary/Secondary plumbing configuration (see Figures 10-5 and 10-6) using the listed pipe size in the Boiler-Primary Loop, with up to 50 equivalent feet of pipe length. The installer is responsible for sizing the boiler circulator(s) and piping for applications using non Primary/Secondary plumbing; Figure 10-4 provides Head Loss curves for this purpose.

⚠ WARNING

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.

Table 10-4 Circulator and Pipe Size Requirements

Model	Temp. Rise (ºF)	Boiler Flow Rate (GPM)	Boiler Head Loss (ft)	Minimum Pipe Size	Minimum Primary Loop Pump Size[1]			
					B&G	Grundfos	Taco	Armstrong
Tft60	20	6	2.7	1”	NRF-22	UPS15-58 (2)	005	Astro 30 (2)
	25	4	1.6	¾”	NRF-22	UPS15-58 (1)	005	Astro 30 (2)
	35	3	1.0	¾”	NRF-9	UPS15-58 (1)	005	Astro 30 (1)
Tft85	20	8	3.4	1”	NRF-22	UPS15-58 (2)	007	Astro 30 (3)
	25	6	2.7	1”	NRF-22	UPS15-58 (2)	005	Astro 30 (2)
	35	4	1.6	¾”	NRF-22	UPS15-58 (1)	005	Astro 30 (2)
Tft110	20	10	3.9	1” [2]	NRF-22[(2)]	UPS15-58 (3)	007 [2]	Astro 30 (3) [(2)]
	25	8	3.4	1”	NRF-22	UPS15-58 (2)	007	Astro 30 (3)
	35	6	2.7	1”	NRF-22	UPS15-58 (2)	005	Astro 30 (2)
Tft155	20	14	5.3	1-1/4”	NRF-25 (3)	UPS26-99 (2)	0011	E7
	25	11	3.9	1-1/4”	NRF-22	UPS15-58 (3)	007	Astro 30 (3)
	35	8	3.1	1”	NRF-22	UPS15-58 (2)	007	Astro 30 (3)
Tft175	20	16	6.6	1-1/2”	NRF-36 (2)	UPS26-99 (2)	0011	E7
	25	13	4.7	1-1/4”	NRF-25 (3)	UPS26-99 (2)	0010	E7
	35	9	3.4	1”	NRF-22	UPS15-58 (3)	007	Astro 30 (3)
Tft200	20	18	7.5	1-1/2”	NRF-36 (2)	UPS26-99 (2)	0011	E7
	25	15	5.8	1-1/4”	NRF-36 (2)	UPS26-99 (2)	0011	E7
	35	11	3.9	1-1/4”	NRF-22	UPS15-58 (3)	007	Astro 30 (3)
Tft250	20	23	11.3	1-1/2”	NRF-36 (3)	UPS26-99 (3)	0013	E8
	25	18	7.5	1-1/2”	NRF-36 (2)	UPS26-99 (2)	0011	E7
	35	13	4.7	1-1/4”	NRF-25 (3)	UPS26-99 (2)	0010	E7
Tft300	20	28	5.4	2”	NRF-36 (3)	UPS26-99 (3)	0012	E8
	25	22	4	1-1/2”	NRF-36 (2)	UPS26-99 (3)	0011	E7
	35	16	3.1	1-1/2”	NRF-25 (3)	UPS26-99 (2)	0010	E7
Tft399	20	37	8.2	2”	PL55	UPS26-150 (3)	2400-30	E11
	25	29	5.7	2”	NRF-36 (3)	UPS26-99 (3)	0012	E8
	35	21	3.9	1-1/2”	NRF-36 (2)	UPS26-99 (2)	0011	E7

Notes:

[1] Pump sizing based on Primary/Secondary plumbing configuration with specified minimum pipe diameter with up to 50’ equivalent length.

[2] Upsize piping to 1-1/4” if using Taco 007, Armstrong Astro 30 or B&G NRF-22; alternatively upsize circulator to 0010, Astro 50 or NRF-25.

Figure 10-4(a) Tft60-110 Head Loss Curve

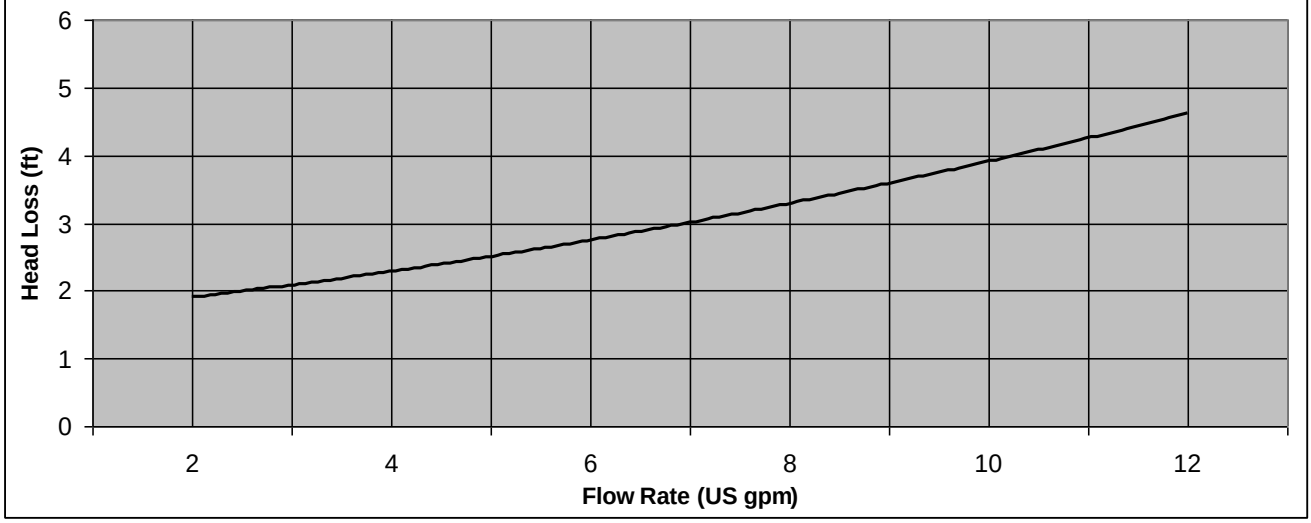


Figure 10-4(b) Tft155-250 Head Loss Curve

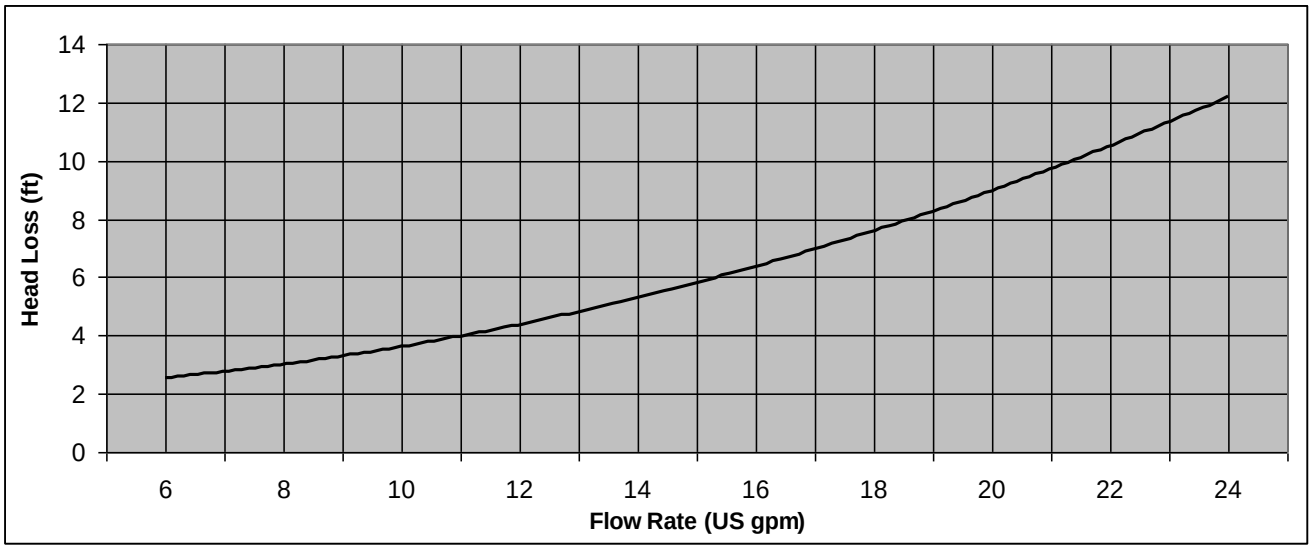
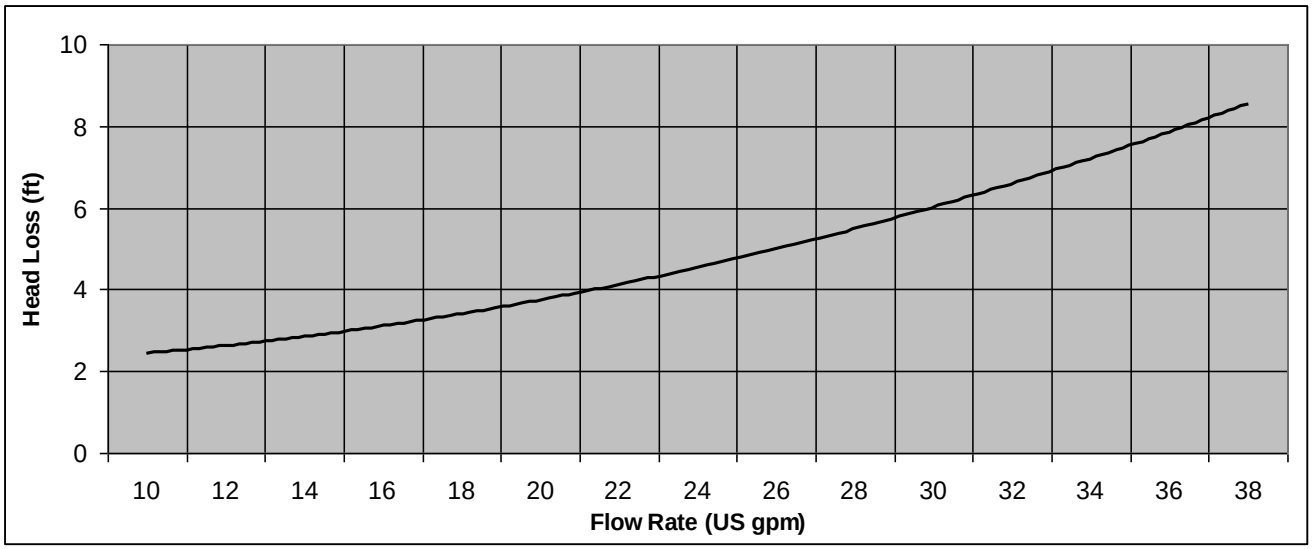


Figure 10-4(c) Tft300-399 Head Loss Curve



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 micro-bubbler, 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., in close proximity to the water fill and expansion tank.

NOTICE

Trinity boilers are supplied with an automatic air removal device to aid in the purging of air from the boiler during the initial fill. Place this devise in the location indicated in Figures 10-1 through 10-3.

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 10-5 and 10-6.

⚠ 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 10-5 and 10-6.

Indirect Fired Water Heater – When installed as per Figure 10-6, 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.

Figure 10-5: Single System Circulator Configuration - Often used in applications zoned with “Zone Valves”. During a demand for central heat, the boiler energizes the System Circulator via the Central Heating (CH) pump output (PUMP C). The System Circulator must be sized to provide adequate circulation throughout the heating system. During a Domestic Hot Water (DHW) demand, the boiler de-energizes the System Circulator (PUMP C) and energizes the DHW Circulator (Pump A). With this configuration the Boiler Circulator is the only pump that causes flow through the boiler and it is powered during any demand via the boiler pump output (PUMP B). This circulator must be sized according to Table 10-4.

NOTICE

The piping configuration described above requires the Central Heating system and DHW system to be de-coupled from the “Primary Loop” via closely spaced tees (Figure 10-5).

Figure 10-6: Multiple System Circulator Configuration - Often used in applications with “Zone Circulators”. This configuration requires the installation of a check valve located at each circulator. During a central heating demand the boiler energizes the Central Heat Circulator via the Central Heat pump output (PUMP C). During a Domestic Hot Water (DHW) demand, the boiler de-energizes PUMP C and energizes the DHW Circulator (Pump A). Both Pump A and C, used in this configuration, are responsible for water flow through the boiler and must be sized according to Table 10-4. Pump output, PUMP B is not used in this configuration.

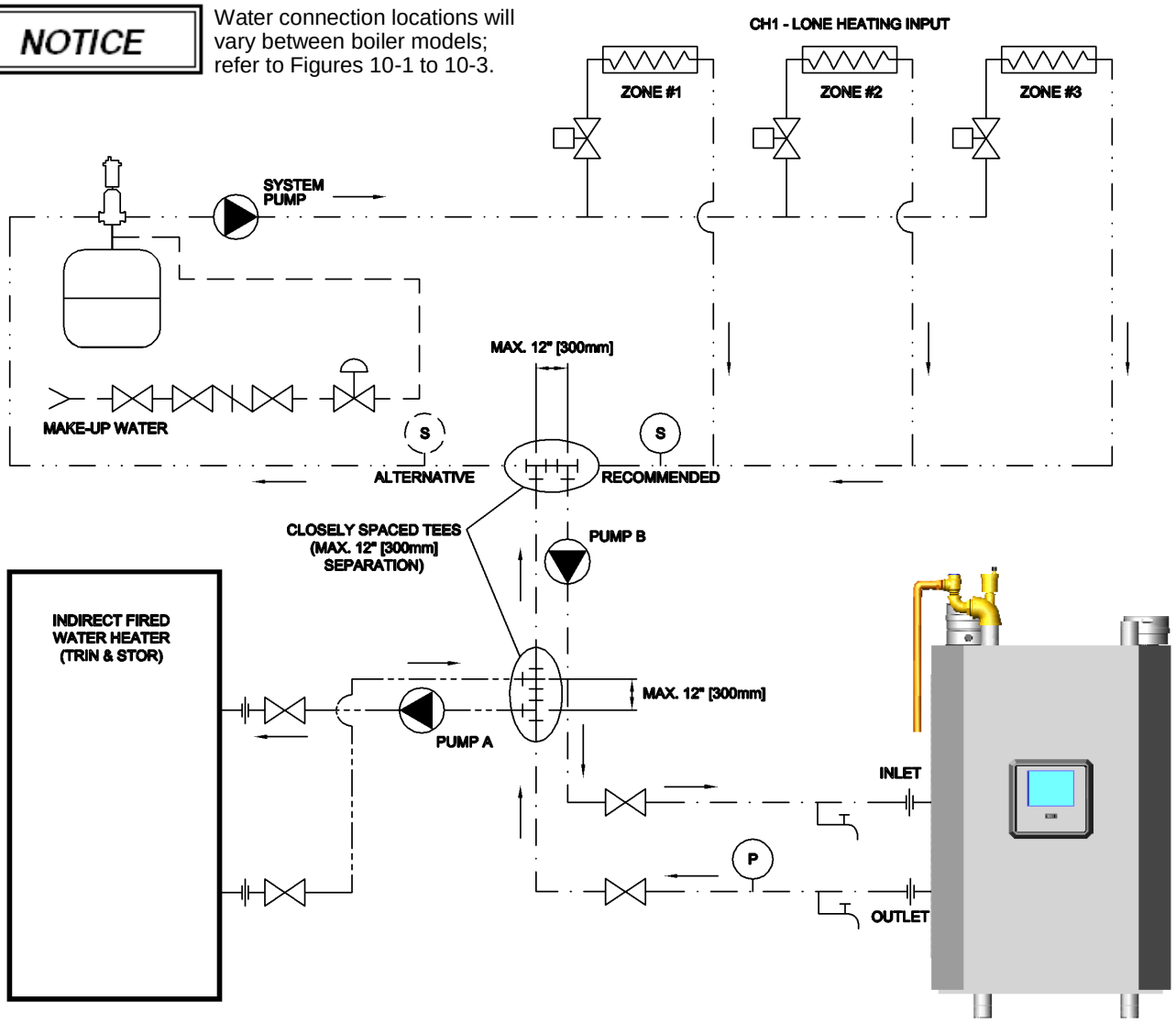
NOTICE

Figures 10-5 and 10-6 illustrate typical piping systems. These piping schematics do not illustrate all of the required concepts and components required to have a proper installation. Concepts not shown include: prevention of thermal-siphoning (heat traps), isolation valves, drain and purge valves, etc. It is the responsibility of the installing contractor and system designer to determine which system best meets the need of the installation and to consider all aspects of a proper system design. Contractor modifications to these instructions may be required, based upon existing piping and system design.

Figure 10-5 Primary/Secondary Plumbing
(Single System Circulator Configuration)

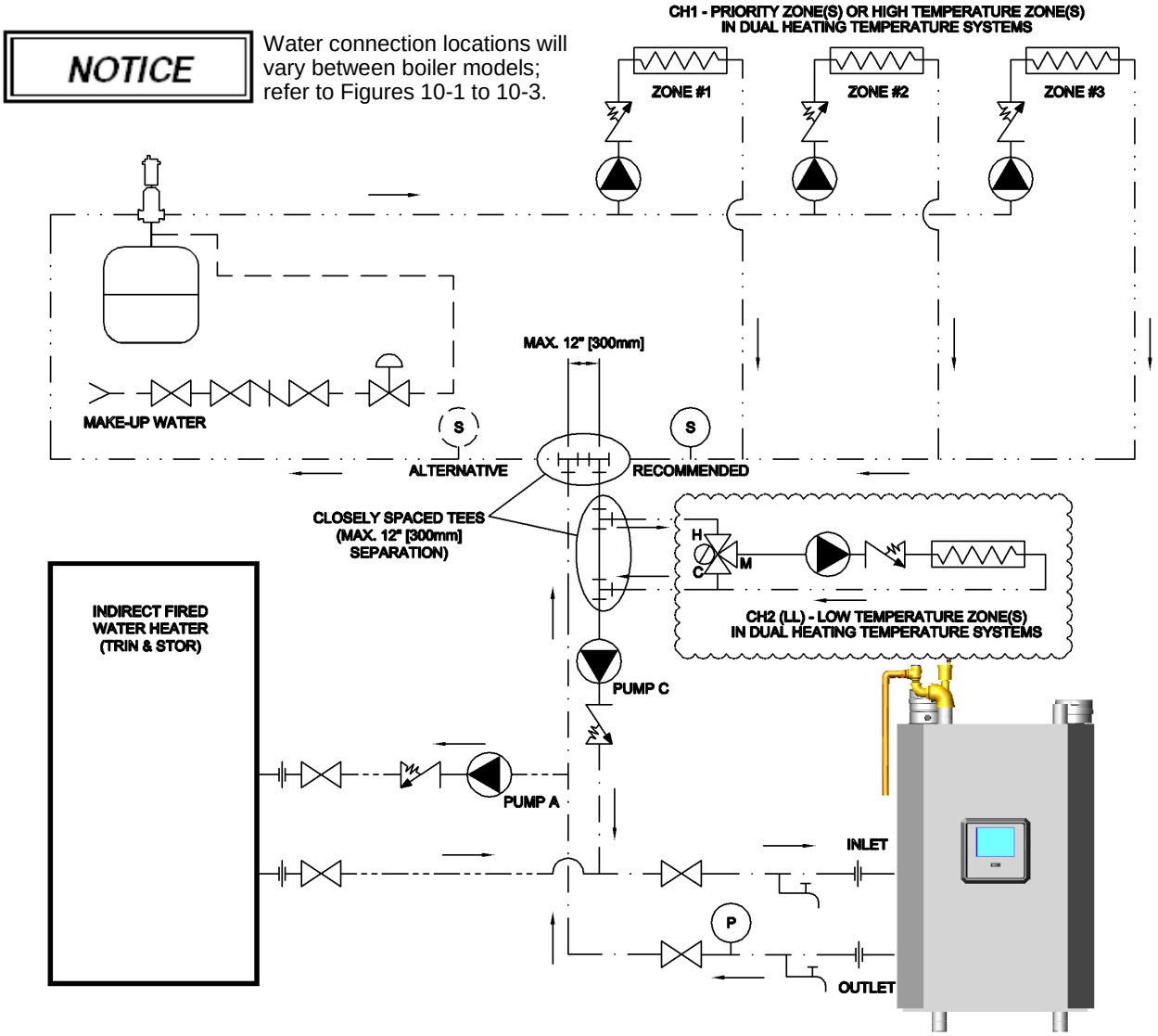
NOTICE

Water connection locations will vary between boiler models; refer to Figures 10-1 to 10-3.



LEGEND					
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MAKE-UP WATER		BACKFLOW PREVENTOR		AIR SEPARATOR
	PRIMARY LOOP		PRESSURE RELIEF VALVE		PUMP
	CENTRAL HEATING SECONDARY LOOP		PRESSURE REGULATING VALVE		UNION
	DHW SECONDARY LOOP		DRAIN VALVE		TEE
	ISOLATION VALVE		AIR VENT		FLOW DIRECTION
	ZONE VALVE		EXPANSION TANK	S	SYSTEM SENSOR
	ZONE LOAD	P	PRESSURE GAUGE		

Figure 10-6 Primary/Secondary Plumbing
(Multiple System Circulator Configuration)



LEGEND					
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MAKE-UP WATER		BACKFLOW PREVENTOR		AIR SEPARATOR
	PRIMARY LOOP		PRESSURE RELIEF VALVE		PUMP
	CENTRAL HEATING SECONDARY LOOP		PRESSURE REGULATING VALVE		UNION
	DHW SECONDARY LOOP		DRAIN VALVE		TEE
	ISOLATION VALVE		AIR VENT		FLOW DIRECTION
	ZONE VALVE		EXPANSION TANK		SPRING CHECK VALVE
	ZONE LOAD	P	PRESSURE GAUGE	S	SYSTEM SENSOR
H C M	THERMOSTATIC MIXING VALVE		OPTIONAL		

11.0 LEAD LAG INSTRUCTIONS

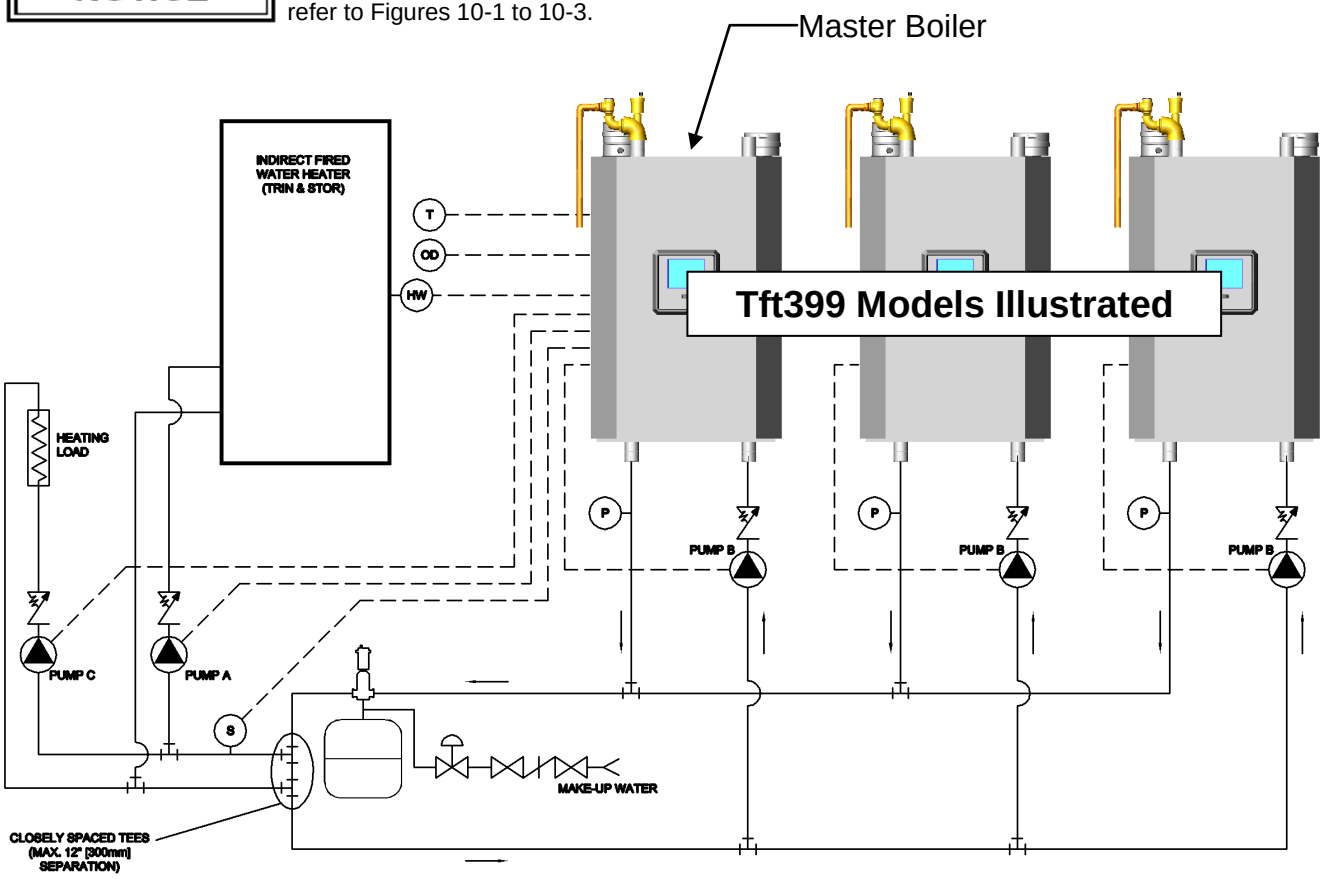
Multiple Boiler Applications

The Tft controller has the internal capacity to stage or Lead-Lag up to 8 boilers configured in a cascade. This Lead-Lag capability allows a designated "Master" boiler to communicate with and effectively control each boiler in a multiple boiler system. This function is accomplished by "Daisy Chaining" a 3-wire cable between each of the boilers and enabling the Master parameter in the boiler of your choice. The boiler with the Master parameter enabled becomes the single point of contact for Central Heating, Domestic Hot Water and Outdoor Reset settings and control wiring. Use the instructions detailed in this section to set-up and install the cascade boiler system; reference *Appendix A – Controller and Touchscreen Display Instructions* for details on more advanced settings and for assistance with navigating the touchscreen display.

Figure 11-1 Multiple Boiler Lead-Lag Plumbing Configuration

NOTICE

Water connection locations will vary between boiler models; refer to Figures 10-1 to 10-3.



LEGEND							
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
S	SYSTEM SENSOR	P	PRESSURE GAUGE		AIR SEPARATOR		CHECK VALVE
T	CH2 THERMOSTAT		WATER PIPING		AIR VENT		BACKFLOW PREVENTOR
OD	OUTDOOR SENSOR		WIRING		EXPANSION TANK		PRESSURE REGULATING VALVE
HW	TANK THERMOSTAT		FLOW DIRECTION		HEATING LOAD		PUMP

Lead Lag Instructions - Common

Plumbing – install as many as 8 Tft boilers in parallel in a primary/secondary plumbing configuration as illustrated in Figure 11-1. Size common piping as per Table 11-1.

Boiler Pump – each boiler must have its own circulator (see Figure 11-1) which is controlled by its *PUMP B* output; see *Field Wiring* Figure 12-1 and Table 12-1. The Boiler Pump must be sized according to Table 10-4.

Communication Wiring – using 3-wire cable, daisy-chain terminals *DATA +*, *DATA –* and *DATA COM* of each boiler in parallel; see *Field Wiring* Table 12-2a and Figure 12-2.

System Sensor (Optional) – install a system sensor (NTI P/N: 84010) on the outlet (supply) pipe feeding the heating system, see Figure 11-1. Wire the system sensor to *SENSOR COM* and *SYSTEM* of the Master Boiler; see *Field Wiring* Table 12-2a and Figure 12-2. The system sensor automatically becomes the modulation sensor for the boiler system, i.e. the control attempts to achieve setpoint temperature at the location of the sensor. If a system sensor is **NOT** used, at the Master boiler set the applicable sensor input to *Unconfigured* as follows:

Configure – Sensor Configuration – S10 (J10-7) sensor

Outdoor Sensor (Optional) – wire the outdoor sensor to *SENSOR COM* and *OUTDOOR* of any one of the boilers in the cascade; see *Field Wiring* Table 12-2a and Figure 12-2. Note: only one outdoor sensor is needed for the multiple boiler system.

Modbus Address – assign a unique *MB2 Modbus Address* to each boiler in the cascade. Access the *MB2 Modbus Address* setting via the *System Identification & Access* menu as follows:

Configure – System Identification & Access – MB2 Modbus Address

Master Enable – choose **<u>one</u>** (and only one) boiler in the cascade to be the Master, this boiler will receive all control wiring and will be used for setting control parameters (see steps below). On this one boiler, set *Master enable* equal to *Enabled* via the *Lead Lag Master Configuration* menu, accessed as follows:

Configure – Lead Lag Master Configuration – Master enable

Table 11-1 Minimum Pipe Sizes for Multiple Boiler Applications

# of Units	Tft60	Tft85	Tft110	Tft155	Tft175	Tft200	Tft250	Tft300	Tft399
	Pipe Size	Pipe Size	Pipe Size	Pipe Size	Pipe Size	Pipe Size	Pipe Size	Pipe Size	Pipe Size
2	1”	1-1/4”	1-1/2”	1-1/2”	2”	2”	2”	2-1/2”	2-1/2”
3	1-1/4”	1-1/2”	2”	2”	2”	2-1/2”	2-1/2”	3”	3”
4	1-1/2”	2”	2”	2-1/2”	2-1/2”	2-1/2”	3”	3”	3”
5	1-1/2”	2”	2-1/2”	2-1/2”	3”	3”	4”	4”	4”
6	2”	2”	2-1/2”	3”	3”	4”	4”	4”	5”
7	2”	2-1/2”	2-1/2”	3”	4”	4”	4”	4”	5”
8	2”	2-1/2”	3”	3”	4”	4”	4”	5”	5”

Note: Minimum pipe size based on assumed temperature rise of 25ºF at maximum firing rate.

Lead Lag Instructions – Central Heating

Central Heat Demand Switch (Room Thermostat) – connect to *R (24VAC)* and *CH2 (LL)* of the Master Boiler; see *Field Wiring* Table 12-2b and Figure 12-2. Switch must be an isolated end switch (dry contact).

Central Heat Setpoint – at the Master boiler only, set the *CH setpoint* via the *Lead Lag Master Configuration* menu, accessed as follows:

Configure – Lead Lag Master Configuration – CH setpoint

Outdoor Reset Settings – at the Master boiler only, set the *Outdoor reset* parameters via the *Lead Lag Master Configuration* menu, accessed as follows:

Configure – Lead Lag Master Configuration – Advanced Settings – Outdoor reset

CH Pump – one boiler in the cascade can be chosen to operate the Central Heating pump via its *PUMP C* output; see *Field Wiring* Figure 12-1 and Table 12-1. From the respective boiler display, check the box next to *Use for Lead Lag Master demands* for the CH Pump to ensure proper pump behavior. Menu access to the CH Pump parameters is as follows:

Configure – Pump Configuration – Central Heat pump – Use for Lead Lag Master demands

Lead Lag Instructions – Domestic Hot Water

Tank Thermostat – connect to *SENSOR COM* and *DHW* of the Master Boiler; see *Field Wiring* Table 12-2a and Figure 12-2. Switch must be an isolated end switch (dry contact).

DHW Setpoint – at the Master boiler only, set the *DHW setpoint* via the *Lead Lag Master Configuration* menu, accessed as follows:

Configure – Lead Lag Master Configuration – DHW setpoint

DHW switch (Lead Lag) – at the Master boiler only, set *DHW switch* equal to *DHW (S6) sensor shorted* via the *Lead Lag Master Configuration* menu, accessed as follows:

Configure – Lead Lag Master Configuration – Advanced Settings – Domestic Hot Water – DHW switch

DHW enable (Local) – at the Master boiler only, set *DHW enable* equal to *Disabled* via the *Domestic Hot Water Configuration* menu, accessed as follows:

Configure – Domestic Hot Water Configuration – DHW enable

DHW Pump – one boiler in the cascade can be chosen to operate the DHW pump via its *PUMP A* output; see *Field Wiring* Table 12-2b and Figure 12-2. From the respective boiler display, check the box next to *Use for Lead Lag Master demands* for the DHW Pump to ensure proper pump behavior. Menu access to the DHW Pump parameters is as follows:

Configure – Pump Configuration – DHW pump – Use for Lead Lag Master demands

NOTICE

Tank Sensor – when operating in a cascade system, the boiler controls do not support the use of a tank sensor; a tank thermostat (switch) must be used.

12.0 FIELD WIRING

All wiring must be in accordance with the Canadian Electrical code, CSA C22.2 and any applicable local codes. Ensure that the wiring complies with this manual. The boiler must be electrically grounded in accordance with the National Electrical Code ANSI/NFPA 70, local codes, and/or the Canadian Electrical Code CSA C22.1.

⚠ WARNING

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.

CAUTION

Field Wiring - Wire grommets must be used to secure wiring and prevent chafing when passing wiring through the cabinet wall. Failure to follow instructions may damage unit.

Line Voltage Connections

Electrical rating for the Trinity Tft is 120V / 1 Phase / 60 Hz / 12A. All line voltage wiring connections to the Trinity Tft are made at the junction box in the control panel located at the bottom of the boiler cabinet. The connections are accessed by removing the front door of the boiler, followed by the removal of the control panel cover. Field connections are to be installed in accordance with Figure 12-1 and Table 12-1. Holes are located on the bottom (underside) of the control panel junction box.

Fuses (120VAC) – The Trinity Tft is equipped with two 7 Amp fuses to protect 120VAC system components. The fast-acting fuses are located on the left side of the control panel and are easily accessed upon removal of the front cover of the boiler cabinet.

- Fuse A: Protects the blower, spark generator and PUMP B output circuits.
- Fuse B: Protects PUMP A and PUMP C output circuits.

⚠ WARNING

Wire Protection - When passing any 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.

⚠ WARNING

Power Supply - The Trinity Tft is designed to 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 instructions may result in component failure, serious injury or death.

⚠ CAUTION

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.

CAUTION

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.

NOTICE

Max Load - Circulator outputs (PUMP A, B, C) are each limited to operating a circulator with a maximum current load of 3 Amps or a maximum 1/6 hp motor. See Table 12-1.

Figure 12-1 Line Voltage Field Wiring

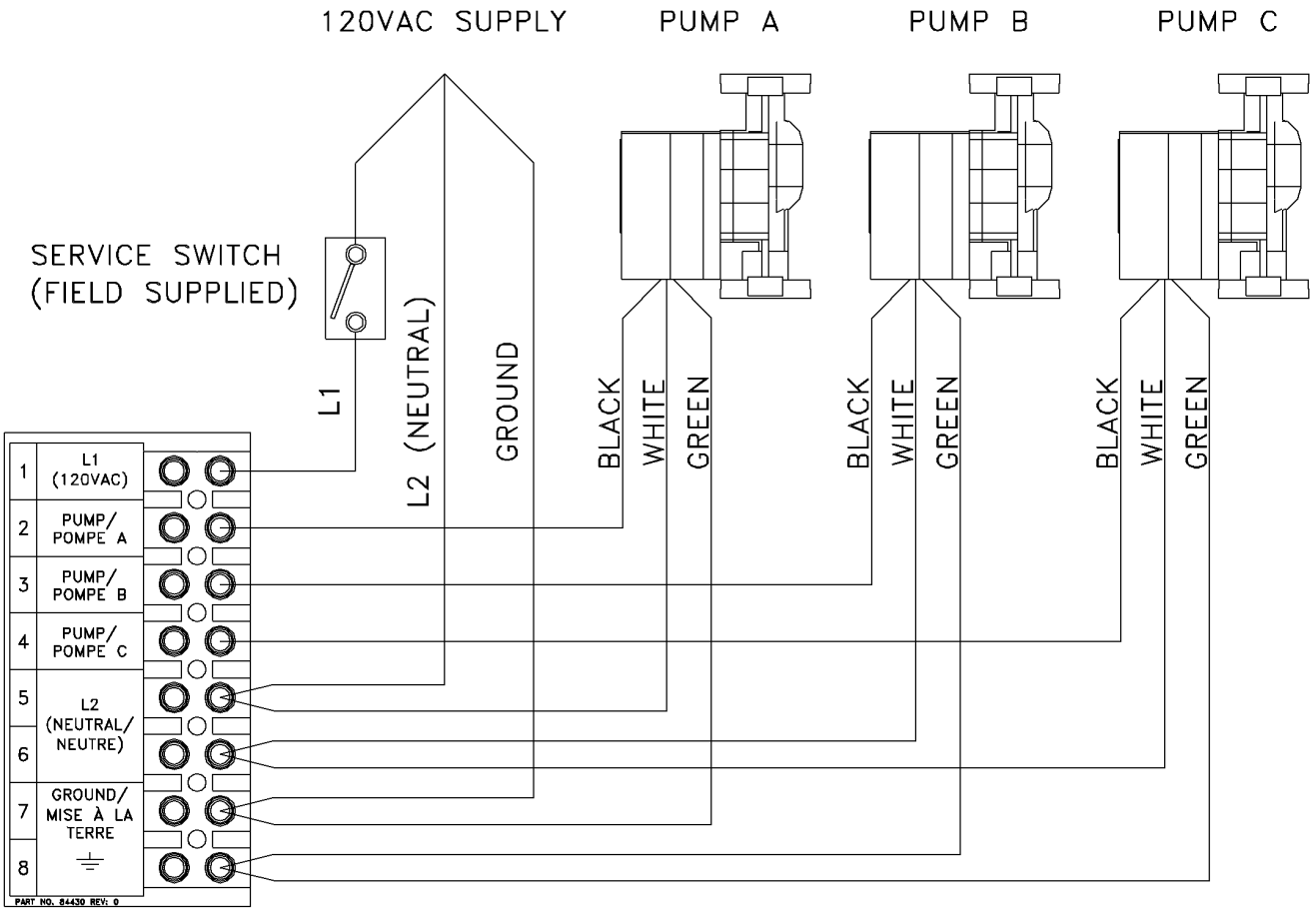


Table 12-1 Line Voltage Field Connections

Connection	Location	Description
L1 (120VAC)	1	Location for connecting line voltage of the power supply. Note; most installation codes require the installation of a service switch to break line voltage to the appliance.
PUMP A	2	120VAC output to the DHW circulator; powered during a demand for DHW.
PUMP B	3	120VAC output to the Boiler circulator; powered during all demands; DHW, local Central Heat (CH1) and Lead-Lag Central Heat [CH2 (LL)]. This output is not used for all plumbing configurations, see Section 10.0.
PUMP C	4	120VAC output to the Central Heating circulator; powered during a demand for local Central Heat (CH1) or Lead-Lag Central Heat [CH2 (LL)].
L2 (Neutral)	5	Location for connecting neutral of the power supply and all circulators.
	6	
Ground	7	Location for connecting earth ground and for grounding all of the circulators.
	8	

Low Voltage Connections

Like the line voltage, the low voltage wiring connections to the Trinity Tft are made at the junction box in the control panel located at the bottom of the boiler cabinet. The connections are accessed by removing the front door of the boiler, followed by the removal of the control panel cover. Field connections are to be installed in accordance with Figure 12-2 and Tables 12-2a and 12-2b. Holes are located on the bottom (underside) of the control panel junction box.

NOTICE

Fuse (24VAC) - Trinity Tft models are equipped with a "blade style" 2 Amp fuse to protect the internal transformer located within the control panel box.

Table 12-2a Low Voltage Field Connections (Communication and Sensor I/O)

Connection		Location	Description
COMM.	DATA +	1	**Lead-Lag** – Terminals 1, 2 and 3 can be "daisy-chained" to multiple boilers (up to 8 in total) for the purpose of staging. For lone boiler applications, these terminals can be alternatively used for communication to an external device (i.e. Building Automation System, BAS)
	DATA -	2	
	DATA COM	3	
4-20mA (+)		4	**External Modulation Control** – Using a 4-20mA signal connected to terminals 4 and 5, an external control can be used to directly modulate the burner firing rate or adjust the active set point. This can be useful for applications using external staging controls or Building Automation Systems.
4-20mA (-)		5	
SENSOR	COM	6	**Sensor Common** – Common port for field inputs SYSTEM, OUTDOOR and DHW.
	SYSTEM	7	**System Water Temperature** – An optional strap-on System Sensor is available from NTI (P/N 84010). When connected to terminals 6 and 7, the control will indicate a "CH" or "Lead-Lag" temperature. Sensor can be used for direct modulation of system temperature.
	OUTDOOR	8	**Outdoor Temperature Sensor** – A wall mountable OD Sensor is included with each boiler. When connected to terminals 6 and 8, the control will indicate the outdoor temperature and Outdoor Reset function will be operable.
	DHW	9	**DHW Tank Demand** – Input requiring closure of terminals 6 and 9 to initiate a demand for DHW. Switch made via isolated end switch (dry contact) from a thermostat (aquastat) located in an Indirect Fired Water Heater. Or optional DHW Tank Sensor (NTI P/N 84632), see Appendix A for details.

Table 12-2b Low Voltage Field Connections (24VAC I/O)

Connection	Location	Description
COM (24VAC)	1	**24VAC Common** – Neutral for the 24VAC power supply from the boiler. COM can be used in conjunction with terminal R to provide a power source for a digital thermostat.
R (24VAC)	2	**24VAC Hot** - Power supply for inputs LIM, CH1 and CH2 (LL).
	3	
LIM	4	**External Limit** – Input requiring 24VAC from terminal R to permit the burner to operate. Comes factory equipped with a jumper to the R terminal. For installations requiring the use of an additional safety switch, such as a Flow Switch, or auxiliary temperature limit, remove the factory installed jumper and install the normally open isolated contacts of the additional limit in its place.
CH1	5	**Local Central Heat Demand** – Input requiring 24VAC from terminal R to initiate a "local" CH call. Switch is made using an isolated end switch (dry contact) via thermostat, zone controller or other device. Typically used as the lone heat input or as the high temperature input in dual CH temperature systems.
CH2 (LL)	6	**Lead-Lag Central Heat Demand** – Input requiring 24VAC from terminal R to initiate a "lead-lag" CH call. Switch is made using an isolated end switch (dry contact) via thermostat, zone controller or other device. Typically used as a lead-lag input for cascaded boilers or as the low temperature input in dual CH temperature systems.
ALARM	7	**Normally Open Alarm Contacts** – Contacts close during a lockout or other alarm condition. May be connected to a BMS, maximum capacity of 0.63Amps at 24VAC.
	8	

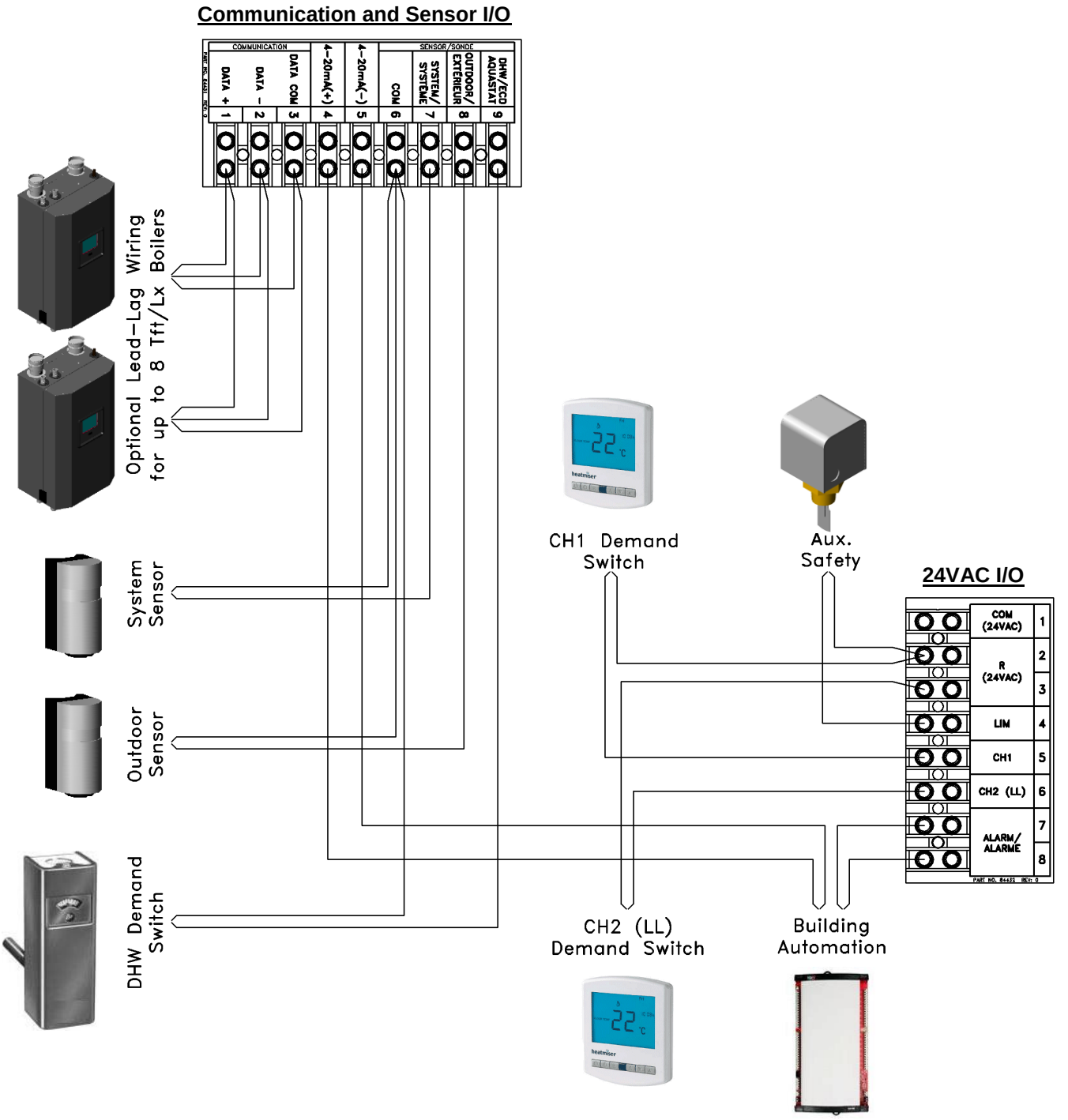
CAUTION

Low Voltage Terminals – "R" terminals 2 and 3 of the 24VAC I/O barrier has 24VAC potential from the internal transformer. Do not connect power from this terminal to any other terminal other than terminals 4, 5 and 6 (LIM, CH1 and CH2 (LL)). Failure to follow these instructions may damage the unit.

NOTICE

The low voltage connections are divided into two separate barrier strips: Communication and Sensor I/O (Input/Output) and 24VAC I/O. **DO NOT** connect 24VAC (or other power supply) to the Communication and Sensor I/O connections; doing so will cause control failure.

Figure 12-2 Low Voltage Field Wiring

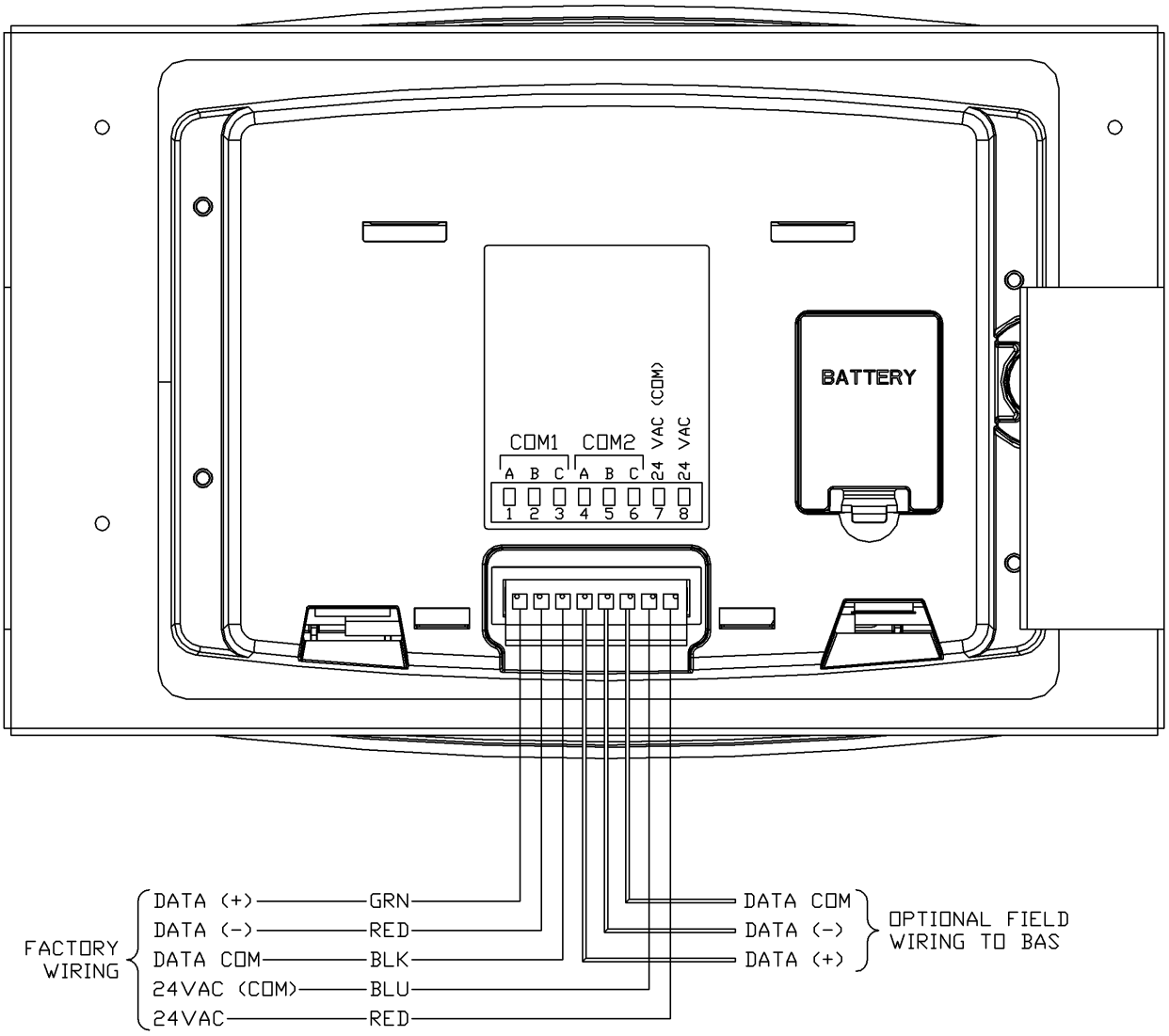


Modbus Communication Connections

The Trinity Tft uses Modbus for communicating data to and from the boiler controller. Effectively the boiler incorporates three (3) Modbus communication ports:

1. **Controller MB1 to Display COM1** – provides communication of all data between the boiler controller and the user interface (touch-screen display). Controller communication port "MB1" is factory wired to communication port "COM1" of the touch-screen display.
2. **Controller MB2 to Field Terminals (see Table 12-2a; Locations 1-3)** – allows for communication between boilers for the purpose of staging/cascading; as many as 8 boilers can be "daisy-chained" together. For lone boiler applications, this port can be alternatively used for communication to an external device (i.e. Building Automation System, BAS). Controller communication port "MB2" is factory wired to Low Voltage field connections DATA (+), DATA (-), and DATA COM (see Figure 12-2).
3. **Display COM2** – the new Tft touch-screen display provides a spare Modbus communication port; the extra port allows for dedicated communication to an external device (i.e. Building Automation System, BAS). Display communication port "COM2" is accessed from the rear of the touch-screen display, see Figure 12-3 for wiring instructions. See Figure 16-3 for instructions on accessing the rear of the touch-screen display.

Figure 12-3 COM2 Modbus Wiring (Rear of Display)



13.0 WIRING SCHEMATICS

Figure 13-1 Tft Connection Diagram

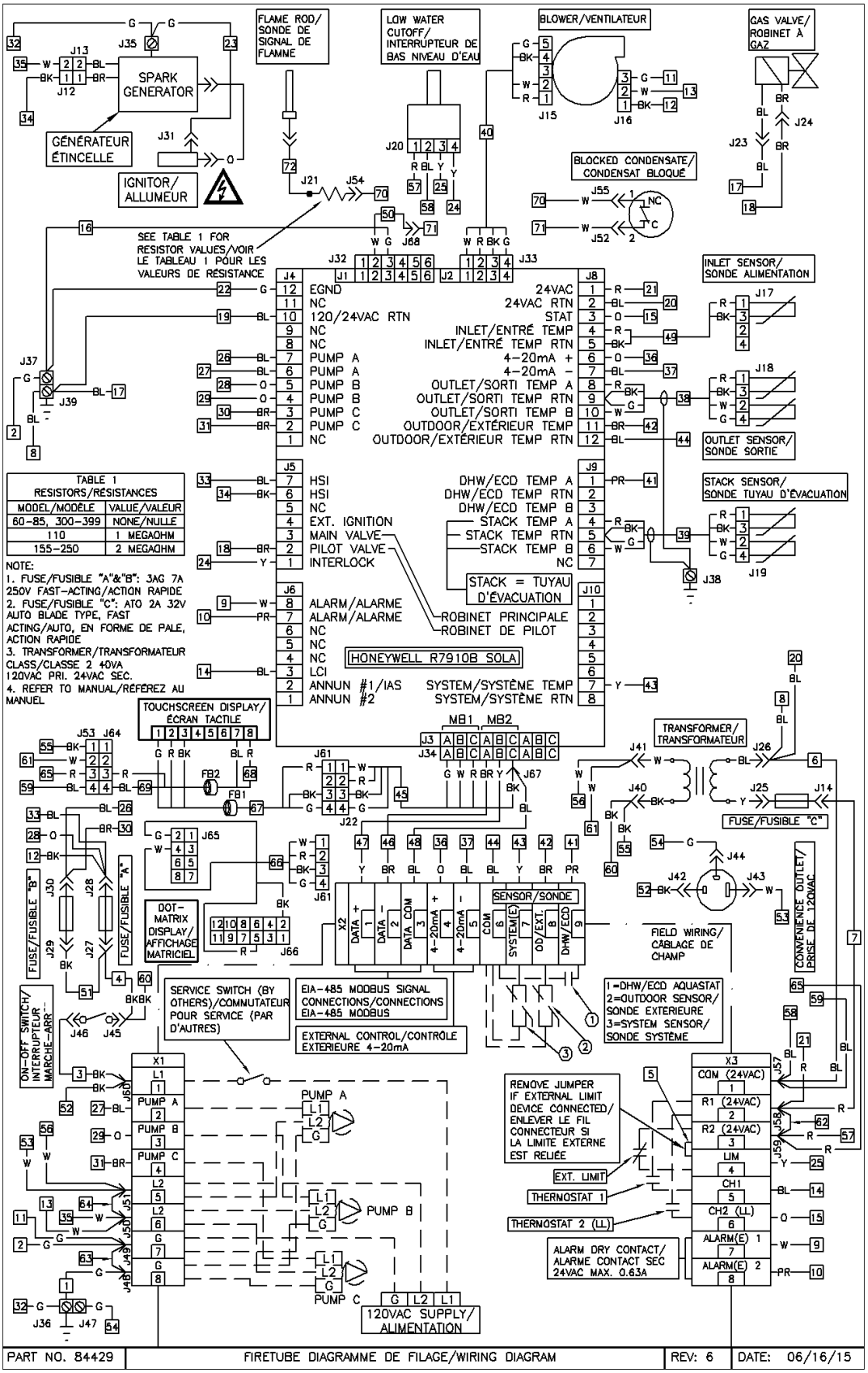
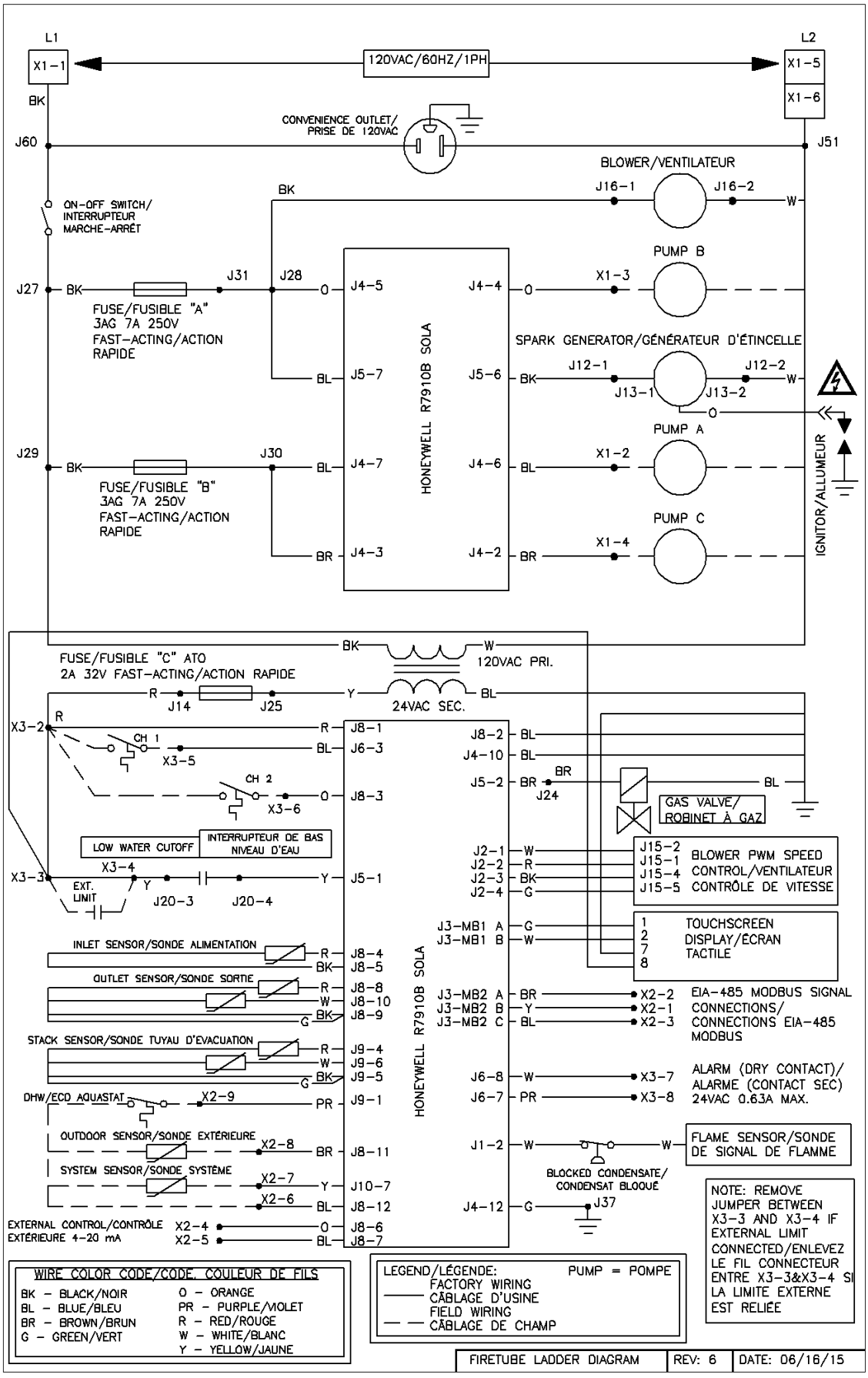


Figure 13-2 Tft Ladder/Logic Diagram



14.0 INSTALLATION CHECKLIST

Installation

- ☐ 1. If operating on Propane Gas, convert boiler using appropriate Kit number. See Table 7-1.
- ☐ 2. Locate the boiler in accordance with Section 3.0 of this manual.
- ☐ 3. Install the Vent/Air-inlet piping in accordance with Sections 4.0 and 5.0 of this manual. Ensure all joints are secured and cemented properly. Both the Vent and Air-inlet pipes must terminate outdoors. Perform the **Mandatory Pre-commissioning Procedure for Plastic Venting** in Section 4.0.
- ☐ 4. Connect the condensate trap and drain in accordance with Section 6.0 of this manual.
- ☐ 5. Connect the gas supply in accordance with Section 7.0 of this manual.
- ☐ 6. Install the plumbing in accordance with this manual; 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 of this manual.
- ☐ 8. Advise home/building owner of their responsibilities with respect to maintaining the boiler.

⚠ WARNING The building owner is responsible for keeping the Vent/Air-inlet 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

⚠ DANGER 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 4.0. 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. Ensure gas line pressure is in accordance with Section 9.0.
- ☐ 7. System is free of combustion leaks.
- ☐ 8. Unit must operate smoothly.
- ☐ 9. Ensure the flue gas combustion readings are within the tolerances listed in Table 9-1.
- ☐ 10. Each ignition must be smooth.
- ☐ 11. 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.

⚠ WARNING 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.

⚠ WARNING 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.