

2.0 BOILER LOCATION

In all cases, the Trinity Ti must be installed indoors in a dry location where the ambient temperature must be maintained above freezing and below 100°F [38°C]. Gas 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 appliance location.



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.

Appliance Area Ventilation Air Openings

If appliance area clearances are less than the recommended clearances specified in Table 2-1, the appliance area must be ventilated. Each ventilation air opening must meet the minimum requirements of 1 in² per 1000 Btu/hr, but not less than 100in². 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.

Closet Installations

For closet installations, it is necessary to provide two ventilation air openings, each providing a minimum area equal to 1 in² per 1000 Btu/hr, but not less than 100 in² and within 6" of the top and bottom of the closet door. All Vent and Air-Intake piping within the closet must be CPVC for both Canada and the US. See Table 2.1 for Minimum and Recommended Clearances.

Alcove Installations

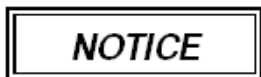
Alcove installations have the same minimum clearances as closet installations, except the front must be completely open to the room at a distance no greater than 18" [457 mm] from the front of the appliance and the room is at least three (3) times the size of the alcove. Provided these conditions are met, the appliance requires no extra ventilation air openings to the space. All Vent and Air-Intake piping within the alcove must be CPVC for both Canada and the US. See Table 2-1 for Minimum and Recommended Clearances.

Residential Garage Installations

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

Table 2-1 Minimum Clearances for Installation and Service


Model No.	Clearances	Dimensions - inches [mm]					
		Front	Top	Sides	Bottom	Rear	Flue/Water Pipe
Trinity Ti100-200	Minimum	24 [610] ¹	12 [305]	12 [305]	9 [229]	0	1 [25]
	Recommended	24 [610]	24 [610]	24 [610] ²	9 [229]	0	1 [25]
Notes: ¹ 6" if surface is removable allowing 24" [610 mm] clearance (i.e. closet installation). See "Appliance Ventilation Air Openings" above. ² Clearances can be as low as 12" [305 mm] on one side if clearance on the other side is 24" [610 mm].							



The appliance area is considered to be a closet or alcove if the area does not provide the recommended clearances listed in Table 2-1. See special instructions under Closet and Alcove Installations.

3.0 VENTING

The Trinity Ti is a “Direct Vent” appliance requiring a “Special Venting System” designed for pressurized venting. Both the Vent and Air-Intake piping must be piped to the outdoors, using the vent material 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. Installations must comply with the National Fuel Gas Code, ANSI Z223.1 (U.S.) or CSA B149.1 (Canada) and local requirements.

 **DANGER**


Vent and Air-Intake to be piped separately. The Trinity Ti cannot share a common vent or air-intake with multiple appliances. Failure to comply will result in serious injury or death.

Combustion Air-Intake Contamination

Be careful not to locate the Air-Intake termination in an area where contaminants can be drawn in and used for combustion. Combustion air containing dust, debris or air-borne contaminants will drastically increase the required maintenance and may cause a corrosive reaction in the Heat Exchanger which could result in premature failure, fire, serious injury, or death. See Table 3-1 for a list of areas to avoid when terminating air-intake piping:

Table 3-1 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
Calcium Chloride	De-Icing / Ice Melters
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 appliance. Failure to follow instructions may result in serious injury or death.

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-intake prior to start-up. Avoid using excess cement or primer that may lead to pooling inside the pipe assembly. Freshly assembled piping should be allowed to cure for a minimum of 8 hours before applying power to the gas fired appliance. 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.

Attaching Vent Piping to Boiler

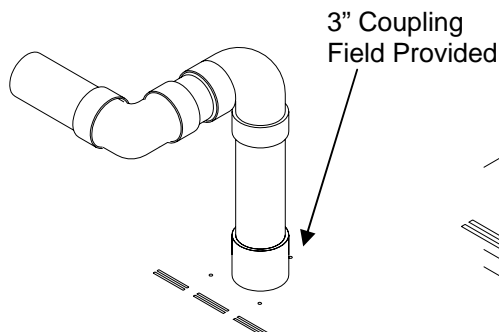
- It is extremely important for the intake and exhaust piping to be adapted to the appropriate size immediately upon exiting the boiler cabinet. Trinity Ti's come with a 3"x1-1/2" PVC adapter to be used to connect immediately to the air intake port of the boiler.
- The Trinity Ti exhaust connection is 3" male PVC, use approved cement to connect to venting system.
- Check the flue outlet gasket for proper insertion and sealing prior to and after attaching the venting.
- Ensure the venting system does not apply a load or stain on the flue outlet of the boiler (recommend using two elbows to create a "swing joint" as shown above).



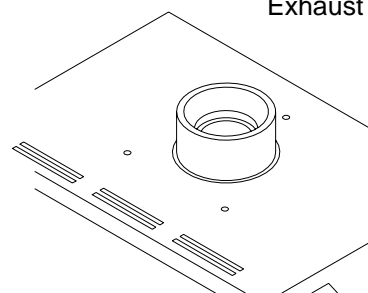
WARNING

When connecting the field provided 3" coupling to the boiler flue outlet connection, ensure the proper cement is used. For applications using CPVC venting, PVC to CPVC transition cement must be used. Failure to follow these instructions may result in property damage, personal injury or loss of life.

It is recommended that two elbows be used, so that the slope of the horizontal exhaust vent does not affect the vertical plumb of the pipe connected to the boiler. Slope all horizontal indoor exhaust venting 1/4" to 1/2" per linear foot.



Ti100-200:
-3" male PVC
Exhaust Fitting.



NOTICE

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

Vent/Air-Intake Pipe Material

Table 3-2 Acceptable Vent and Air-Intake Pipe Material

Items ¹	Materials ^{2, 3}	Installation Standards		WARNING
		United States	Canada ⁴	
Vent Pipe 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.	All plastic Vent materials installed on gas fired appliances in CAN/US must meet the Standards listed in Table 3-2. Failure to comply could result in fire, serious injury or death.
	PVC Schedule 40	ANSI/ASTM D1785		
	CPVC Schedule 40	ANSI/ASTM F441		
Pipe Cement	PVC	ANSI/ASTM D2564		
	CPVC	ANSI/ASTM F493		
Primers	PVC / CPVC	ANSI/ASTM F656		
Notes: ¹ Refer to Table 3-2 for Allowable Vent and Air-Intake Pipe Sizes and Lengths. ² Closet/alcove installations in US and Canada require approved CPVC vent pipe, fittings, cements, and primers. ³ The Air-Intake 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 appliance supply water temperatures greater than 140°F (60°C) must use ULC S636 approved CPVC.				

Mandatory Pre-commissioning Procedure for Plastic Venting



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

1. Working with the power turned off to the appliance, 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 appliance gas supply shut-off valve in the off position.
3. Disconnect electrical leads to the Hot Surface. Ensure the cables are placed in a fashion where they will not arc to ground or other conductor.
4. Turn power on to the appliance 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 electrical leads to the Igniter.

Vent/Air-Intake Pipe Length Determination

Use Table 3-3 to determine the maximum pipe length that can be used. The table calculates sweep, 90° elbows, and 45° elbows at 5 equivalent feet [1.52 m] each. Allowable equivalent pipe lengths for vent and air-intake pipes are shown separately for Natural Gas and LP. **Example:** A Ti200 can be installed with 105 equivalent feet [32 m] of air-intake piping and 105 equivalent feet [32 m] of vent piping when operating with Natural Gas.

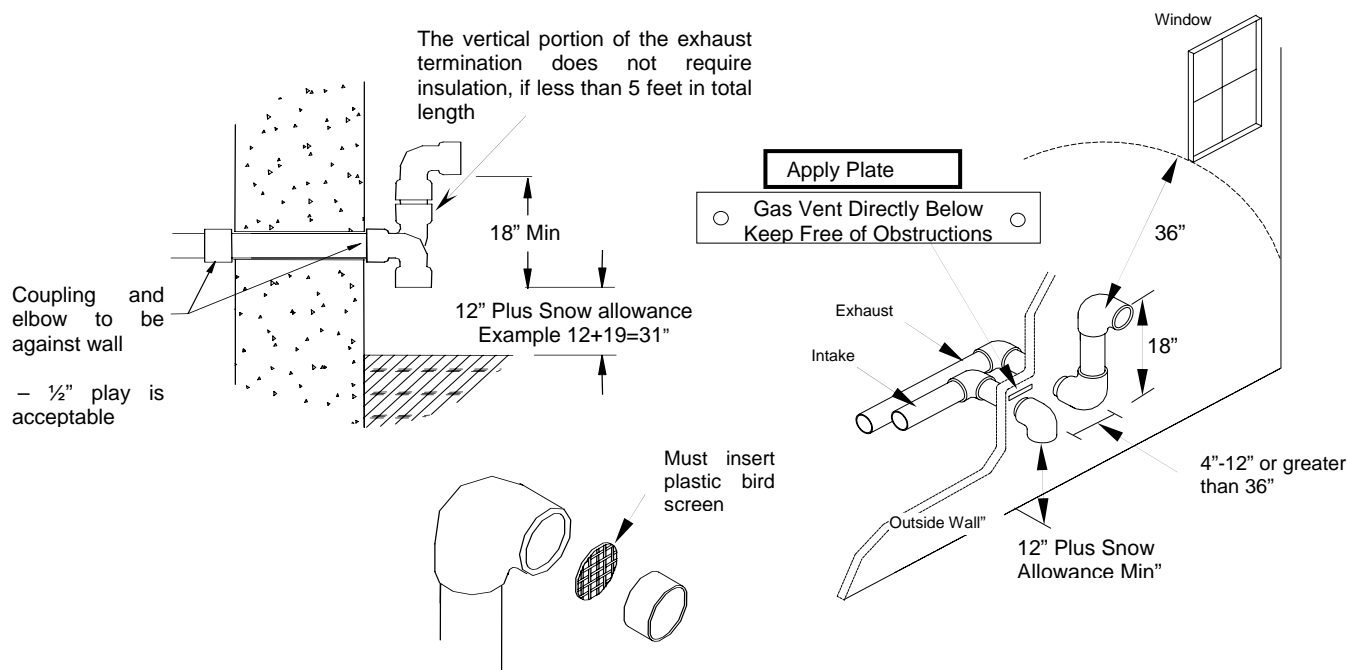
Table 3-3 Allowable Vent and Air-Intake Pipe Size and Lengths

Model No.	Pipe Size	Gas	Length ft. [m]	Number of Elbows (90's or 45's) and Equivalent Feet [Meters]								
				1	2	3	4	5	6	7	8	9
Trinity Ti150 Trinity Ti200	3"	Natural	105 [32]	100 [30.5]	95 [28.9]	90 [27.4]	85 [25.9]	80 [24.4]	75 [22.9]	70 [21.3]	65 [19.8]	60 [18.3]
	3"	LP	50 [15.2]	45 [13.7]	40 [12.2]	35 [10.7]	30 [9.1]	25 [7.6]	20 [6.1]	15 [4.6]	10 [3.0]	5 [1.5]
Trinity Ti100	3"	NG/LP	105 [32]	100 [30.5]	95 [28.9]	90 [27.4]	85 [25.9]	80 [24.4]	75 [22.9]	70 [21.3]	65 [19.8]	60 [18.3]

The length of one vent pipe (intake or exhaust) may not exceed the length of the other vent pipe by more than 20 equivalent feet (6.1 m). Length calculations need not include the three 90° elbows of the exterior vent piping (two outlet, one inlet).

Venting Configurations

Two-Pipe Vent Termination



Concentric Vent Termination Kit - United States

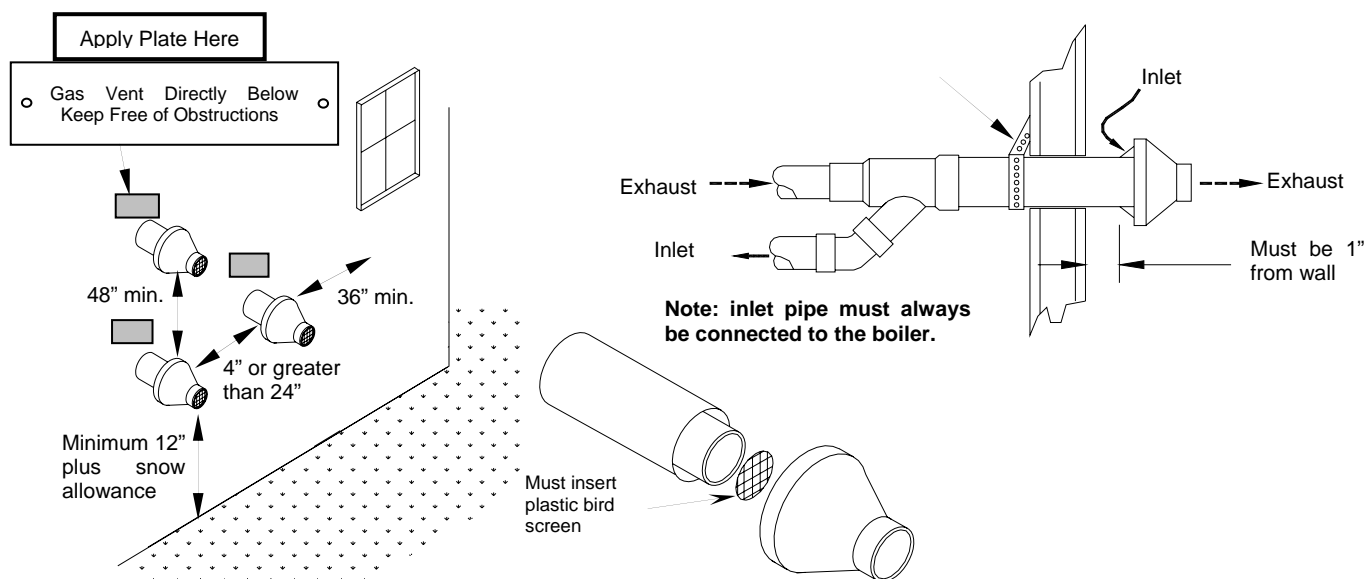
- Use NTI part number 82666 (York part number 1CT0303). **Kits no longer approved for use in Canada.**
- Optional for Trinity models Ti100-200 only (not for use with Lx400).
- Instructions included with vent terminal contain more detailed assembly and installation instructions.
- Clearance requirements in this manual supersede those of the instructions included with the vent terminal.
- Terminal **MUST** be cemented together during installation.

Concentric Vent Termination Kit - Canada

- Use IPEX part number 196006 (Concentric Kit) and 196051 (Vent Screen), certified to ULC S636. Use of this material is subject to approval by local authorities. **Kit 82666/1CT0303 no longer approved for Canada.**
- Optional for Trinity models Ti100-200 only (not for use with Lx400).
- Instructions included with termination kits contain more detailed assembly and installation instructions.
- Clearance requirements in this manual supersede those of the instructions included with the vent terminal.

NTI does not stock System 636 PVC Concentric Vent Termination Kits as they are readily available from IPEX via Canadian wholesalers. Canadian customers wanting more information on System 636 Concentric Vent Kits or wholesaler locations can contact IPEX directly at 1-866-473-9462 (toll free in Canada) or www.ipexinc.com.

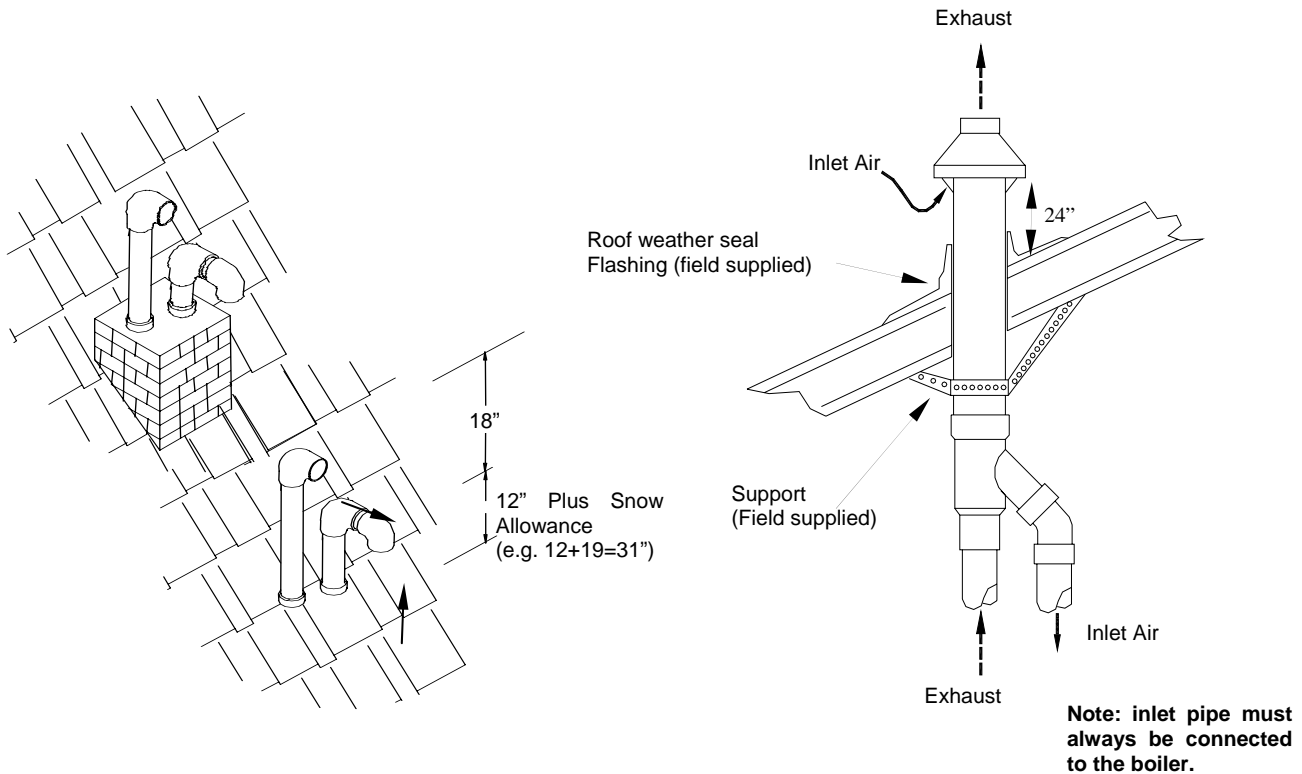
PVC In Canada - Safety authorities in some jurisdictions are not allowing PVC venting materials with appliances of any kind, even if System 636 certified. Check with the local safety inspector to verify compliance prior to installing a PVC Concentric Vent Kit with a Trinity Ti boiler.



Roof Venting

It is permissible to run vent pipe through an existing chimney as long as:

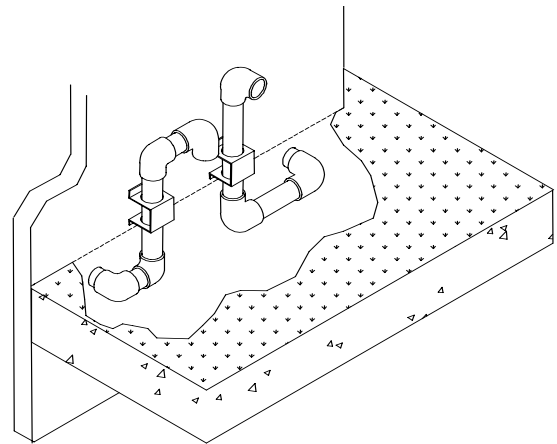
- 1) The chimney is not being used by any other appliance.
- 2) Flue gases don't enter the vacant chimney.
- 3) Only Trinity certified venting materials are used, see Table 3-2.
- 4) Vent lengths are within the maximums specified.



Venting Rules and Guidelines

1. It is highly recommended that the vent terminal be located where it will not be exposed to normal prevailing winds.
2. Air for combustion must be drawn from outdoors from an area free of dust and contaminants. Combustion air containing chemicals such as chloride, fluoride, bromine or iodine, will cause corrosion damage of the heat exchanger voiding your NTI warranty. Avoid drawing combustion air from the vicinity of swimming pools, laundry facilities, workshops, or other areas where the air may contain chemicals or dust.
3. The exhaust must be a minimum of 18" above the air inlet, and the air inlet must always be a minimum of 12" plus snow allowance above any surface that will support snow. (Two feet plus snow allowance is highly recommended). Consult your weather office, for the maximum typical snowfall for your region. Example: New Brunswick Canada the typical maximum snowfall is 19", Thus in figures of Section 3.3, the inlet must be $(12" + 19") = 31"$ off the ground, the exhaust must be $(31" + 18") = 49"$.
4. The horizontal distance between the inlet and exhaust must be a minimum of 4" center to center. If the horizontal distance between the inlet and exhaust is more than 12", increase the vertical separation by the same amount. Example: If horizontal separation is 24", a minimum vertical separation of 30" is required $(24" - 12" = 12")$, so increase minimum vertical separation by 12", $(18" + 12" = 30")$. If horizontal distance is greater than 6', no additional vertical spacing is required. Vertical separation is never required to be greater than 36".
5. Under normal operating conditions this appliance will produce a plume of white gases, and should be taken into consideration when selecting an adequate location. A 3' diameter stainless, plastic, or vinyl shield can be used to flash the exterior of the residence.
6. Elbows on outside of wall must be no greater than 1/2" away from the wall.
7. All indoor exhaust piping must be on a slope back to the boiler a minimum of 1/4" per linear foot of vent. For applications where excessive condensation is possible 1/2" per linear foot is recommended.
8. Exhaust vent pipe can be secured to the wall for more rigidity.
9. In all roof applications the discharge must point away from the pitch of the roof.
10. Install adequate flashing where the pipe enters the roof, to prevent water leakage.
11. Install and seal a rain cap over existing chimney openings, in vacant chimney applications.
12. For installations that exit the wall below grade. Excavate site as shown in figure, to a point below where the pipes are to exit. Ensure that the wall is fully sealed where the pipes penetrate the wall. The vent piping MUST be secured to the side of the building above grade, as shown, to provide rigidity. NTI Provides a mounting bracket PN. 82075 for securing the exhaust pipes. Ensure that the vent clearances are maintained (Inlet minimum 12" plus snow allowance from grade, exhaust outlet 18" minimum above inlet)
13. Install the vent screens provided into both the inlet and exhaust vent terminal elbows. The screen must be on the outside of the last elbow. Install the screen into the female opening of the elbow. Then cut a small piece of pipe to sandwich the screen into the elbow. NOTE be sure that the small piece of pipe cut, does not extend past the end of the elbow. Two screens are provided in the package.
14. It is extremely important that the intake and exhaust piping be adapted to the appropriate size immediately upon exiting the boiler cabinet.
15. All interior vent pipe shall be supported a minimum of every 36".
16. Install the warning plate "Gas Vent Directly Below" 4 feet above the location of the air inlet pipe, so it is visible from at least eight (8) feet away.

Installing Venting Below Grade



Venting Clearances

NOTICE

The following are code restrictions for the location of the Flue gas vent terminal. Compliance doesn't insure a satisfactory installation; good common sense must also be applied.

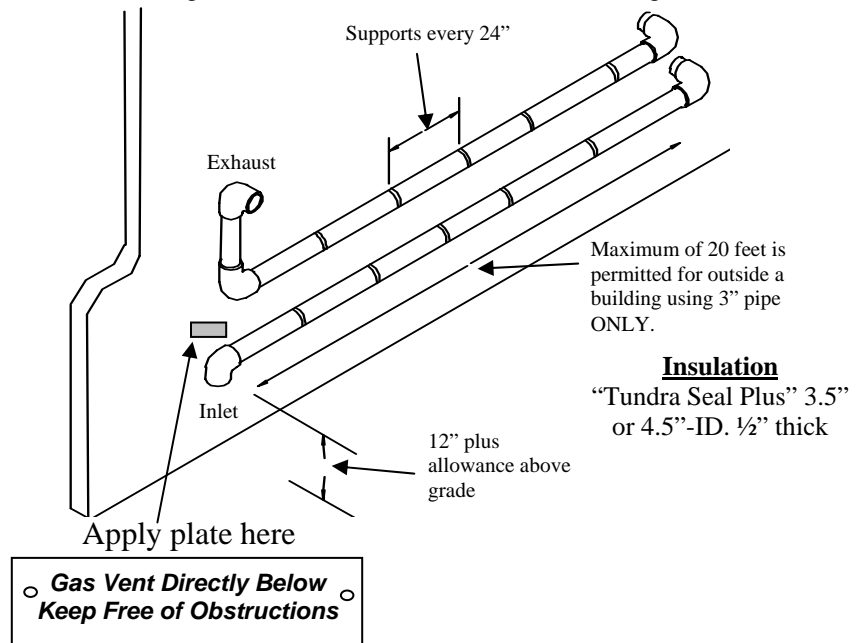
The exhaust vent termination shall not terminate:

1. Directly above a paved sidewalk or a paved driveway that is located between two buildings, and that serves both buildings;
2. Less than 7 feet above grade where located adjacent to a paved walkway or driveway located on public property.
3. Within 3' (three feet) of a window or door that can be opened, or non-mechanical air supply inlet to any building.
4. Within 6' of a mechanical air supply inlet to any building, or roof eve containing soffit openings.
5. Above a meter/regulator assembly within 3' horizontally of the vertical centerline of the regulator.
6. Within 3' horizontally of any gas service regulator vent outlet up to a height of 15'.
7. Less than 30" plus snow allowance above grade, or any surface that will support snow, ice, or debris. The exhaust must be a minimum of 18" above the air inlet, and the air inlet must always be a minimum of 12" plus snow allowance above any surface that will support snow. (Two feet plus snow allowance is highly recommended). Consult your weather office, for the maximum typical snowfall for your region.
8. Underneath a wooden verandah, porch, or deck.
9. Underneath cement verandah, porch, or deck, unless both ends are open and the exhaust pipe is installed at least 24" under the deck floor.
10. So situated that the flue gases are directed towards brickwork, siding, or other construction, in such a manner that may cause damage from heat or condensate from the flue gases.
11. Less than 3' from an inside corner of an L-shaped structure (including walls and fences).

Outdoor Horizontal Venting

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

1. The maximum length outside the building is 20 feet. (Outdoor length must be included in the overall vent length calculation.)
2. Only 3" pipe can be used.
3. All normal termination clearances are maintained.
4. All exterior exhaust vent pipes are insulated with 3.5"-ID, 1/2"-thick **Closed Cell Foamed Polyolefin Tubing** i.e., "**Tundra Seal Plus**" or equivalent.
5. The pipe is supported every 24"
6. The exhaust and inlet are sloped back to the boiler 1/2" elevation for every foot.



4.0 CONDENSATE DRAIN

This unit produces water as a product of combustion. Much of this water condenses on the heat exchanger and in the venting system. All exhaust piping must be on a slope back to the boiler $\frac{1}{4}$ " per linear foot of vent. Steps must be taken to ensure that condensate does not collect in the venting system. Condensate must be drained from the boiler into a household drain.



Failure to properly connect the condensate trap and drain will cause combustion gases to enter the room resulting in property damage, serious injury or death.

Note: check with your municipality, or local gas company to determine if disposal of combustion condensate is permitted. 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 system:

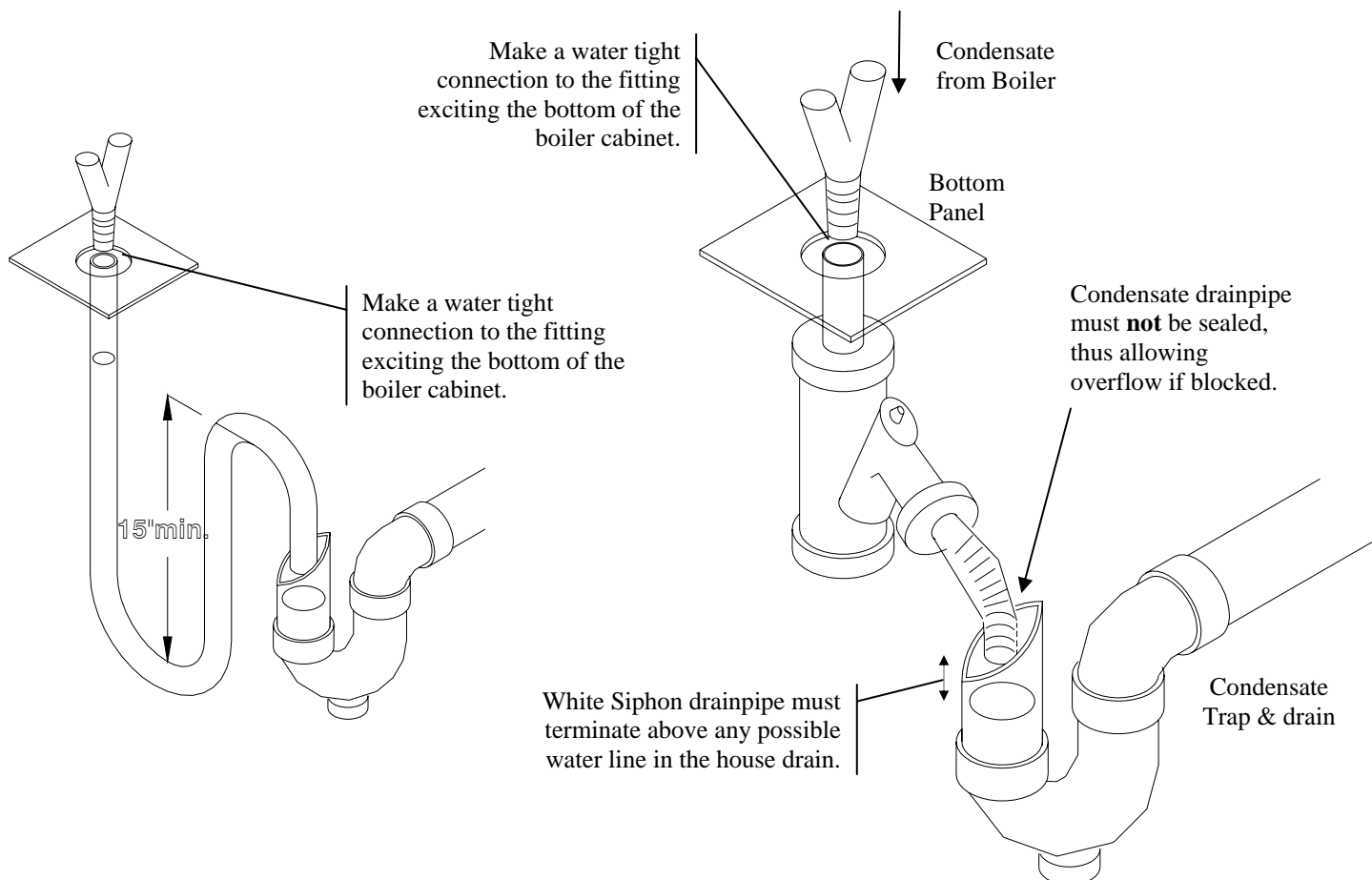
- **DO NOT** run condensate line outside. A frozen or blocked drain will cause the condensate to fill the combustion chamber. This will result in a no heat condition, as the unit will shut down, and damage to the flame sensor, and components can occur.
- **NEVER** use copper, steel, or galvanized piping in the construction of the condensate system (condensate is very corrosive and will rot most metals).
- When a condensate pump is used or required, select a pump that is designed for residential furnaces.



If the condensate drain becomes blocked resulting in condensate backing-up into the heat exchanger, the combustion chamber must be inspected and cleaned and internal refractory must be replaced; see "Combustion Chamber Cleaning" in Section 16.0 for further details. Failure to follow these instructions will result in dangerous boiler operation resulting in property damage, fire or loss of life.



The condensate drain kit supplied with each boiler is susceptible to flooding if the drain hose exiting the kit is lengthened or inserted into a drain. If additional length is required, do not use the drain kit provided, instead fabricate a 15" trap using tubing suitable for condensate disposal.



5.0 INSTALLING GAS PIPING



WARNING The Trinity Ti 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 must be installed prior to installing the gas piping to the appliance. 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; therefore, it is imperative that your appliance is not installed in a pit or similar location that will permit heavier than air gas to collect. Check with Local Codes as they may require appliances fueled with LP gas be provided with an approved means of removing unburned gases from the room. Failure to follow these instructions may result in serious injury or death.

Installation

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

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

Ensure that:

- The gas line connection to the appliance does not apply any weight to the gas valve. NTI recommends using approved flexible gas piping (if acceptable by local codes) to connect the appliance to the gas supply (See Figure 5-1 for details).
- You plan the installation so that the piping does not interfere with the vent pipe, or the removal of the valve, burner, and serviceable components.
- The Appliance shall be 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 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 5-1. Valve must be listed by a nationally recognized testing lab.
- The gas line piping can safely be removed from the appliance for servicing, by strategically placing the gas line shutoff and union; see example in Figure 5-1.
- All gas piping, including gas components in the appliance, are checked for leaks using a "Bubble Test", prior to operating the appliance.



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 Flexible gas piping cannot be used within the appliance cabinet and cannot pass through the cabinet wall, use rigid piping as shown in Figure 5-1. Failure to follow these instructions may result in fire, property damage, serious injury or death.

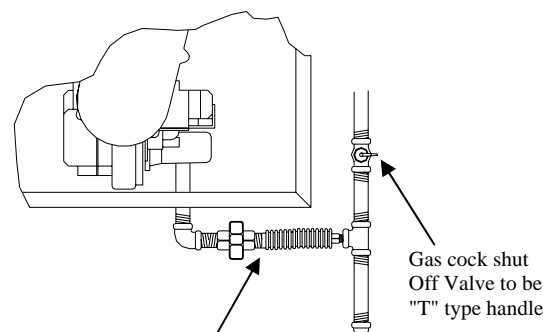


WARNING Do not use an open flame to test for gas leaks. Failure to follow these instructions may result in fire, property damage, serious injury or death.



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

Figure 5-1 Gas Connection



It is highly recommended to use flexible gas pipe, the gas valve and blower cannot support the weight of piping. If piping is used, ensure that the valve supports **NO WEIGHT**

6.0 LIGHTING THE APPLIANCE

DANGER

Before Start-up refer to **Mandatory Pre-commissioning Procedure for Plastic Venting** in Section 3.0. Failure to follow these instructions can result in explosions, injury or death.

DANGER

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

WARNING

Do not store or use gasoline or other flammable vapors & liquids in the vicinity of this or any other appliance. 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 shut off, turn off the manual gas control valve to the appliance. Failure to follow instructions could result in explosion causing property damage, serious injury or death.

FOR YOUR SAFETY, READ BEFORE OPERATING

A) This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B) BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS:

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

C) Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

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

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 appliance.
3. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
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 appliance.
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 Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO THE APPLIANCE

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



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

- Ensure the appliance is wired in accordance with this manual.
- Ensure the gas shut-off 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.



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 3.0. Failure to follow these instructions can result in explosion, serious injury or death.

Initial Start-Up

1. Turn on power to the Trinity Ti and turn-up the Thermostat(s). The appliance 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 7.0 for details).
3. Using an appropriate Oxygen or Carbon Dioxide analyzer, take a sample of the flue gas. The sample must fall within the acceptable ranges for Carbon Dioxide, which is 8.5% - 9.5% for Natural gas, and 9.5%-10.5% for propane (See Section 7.0 for details). Notice: unit shall be operating at maximum firing rate during the combustion test.
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. Ensure that it tries to light, and locks out on safety reset. Once you have successfully activated the flame safety system, replace the wire on the flame sensor, and reconfirm proper lighting.



If the unit fails to light consistently and smoothly, contact NTI for assistance at 1-800-688-2575. Never allow the appliance to continue to operate if the ignition or operation of the burner is rough or erratic. Failure to follow these instructions could 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 appliance.
3. This appliance 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 shut-off 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. If you don’t detect any gas proceed to the next step.
6. Turn the gas shut-off 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 appliance.
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 appliance” and contact a professional service technician, or gas supplier.

Turning Off The Appliance

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

7.0 GAS VALVE AND BURNER SET-UP

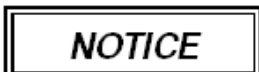


Set-up of the Trinity Ti gas valve must be performed by a licensed Gas Technician. Failure to perform the set-up correctly may result in incorrect operation, component failure, property damage, serious injury or death.

Gas Line Pressure

The appliance gas valve is equipped with a line pressure test port; see Figures 7-1. Use the following procedure to measure the gas line pressure to the appliance to ensure it falls within the range given in Table 7-1:

1. Turn the supply of gas to the appliance 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 appliance.
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 appliance and check for gas leaks.
5. Observe the line pressure under static conditions and compare it to Table 7-1. 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 7-2) and compare the observed line pressure with Table 7-1. The pressure will be lowest during the maximum flow of gas.
7. Adjust the gas line pressure to ensure the parameters in Table 7-1 are attained under all conditions. If possible adjust the line pressure to the "Nominal/Desired" value listed in Table 7-1, while the unit is operating at the maximum modulation rate, see Table 7-2.
8. Continue observing the gas line pressure until the completion of the combustion analyses, in case adjustments need to be made.
9. Upon completion of the line pressure testing, return the bleed screw of the Line Pressure Test Port to the closed position.



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



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

Table 7-1 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	8.5	9.5	175
Propane	11	8	13	9.5	10.5	175

*Note: it is permissible to have higher CO₂ values with the burner operating at the minimum modulation rate.

Table 7-2 Minimum and Maximum "Gas Input Values" (Modulation Rates)

Model	Minimum Gas Input Value	Maximum Gas Input Value
Ti100	50	240
Ti150	50	240
Ti200	40	240

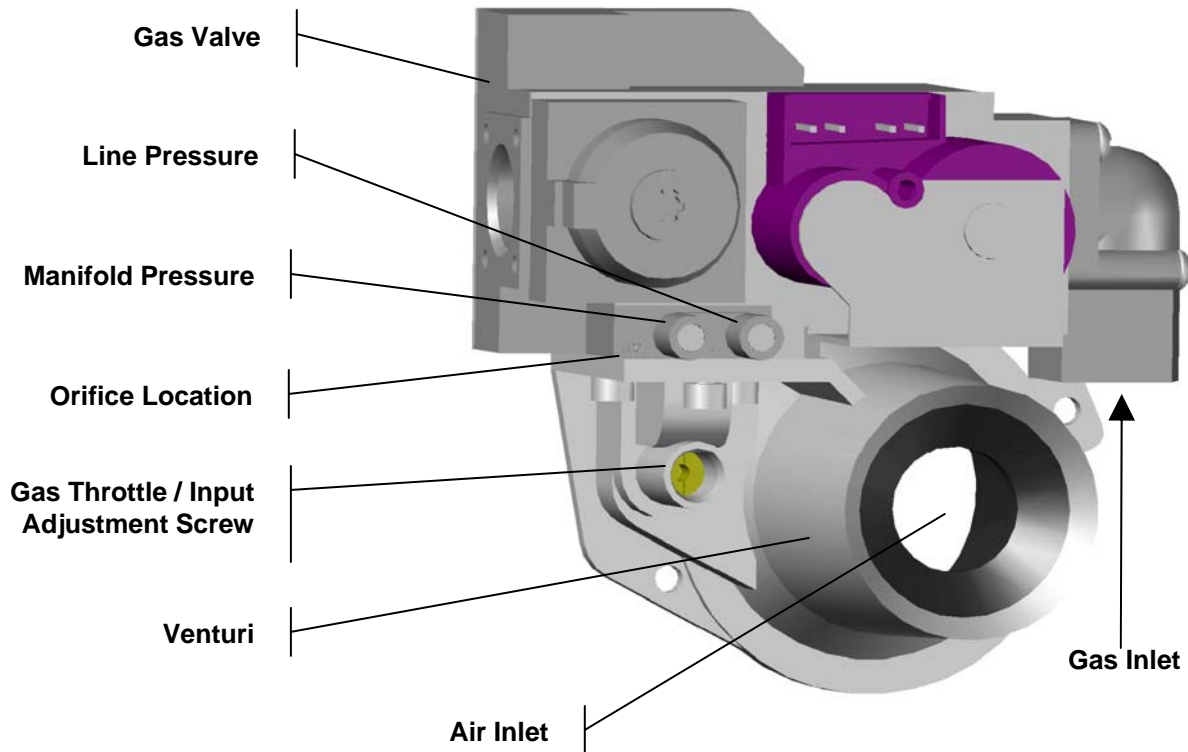


Never leave the unit operating while producing Carbon Monoxide (CO) concentrations in excess of 175ppm. CO concentration will be greatest with the boiler operating at the highest firing rate, therefore measure and make necessary adjustments with unit operating at the Maximum Gas Input Value, see Table 7-2. Failure to follow this warning may result in serious injury or death.



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

Figure 7-1 Gas Valve Venturi Assembly



Adjustment

Input Screw Adjustments - The appliance is equipped with a Throttle/Input Adjustment Screw, located on the Gas Valve and Venturi Assembly. The Throttle screw is used to adjust the flow of gas leaving the gas valve, entering the Venturi and hence entering the combustion air stream. By turning the adjustment screw in, clockwise, the flow of gas is reduced and the combustion becomes leaner, thus reducing the concentration of CO₂ in the flue gases. To increase the CO₂ the Throttle screw must be adjusted out, counterclockwise, thus increasing the flow of gas from the gas valve to the combustion air stream.

The Throttle/Input screw for models Ti100-200 is a multiple turn valve. Fully open to close is approximately 17 turns. Typical adjustment for Natural Gas is 0-1 full turns in or out from its factory position. Typical adjustment for LP Gas is 0-3 full turns in or out from its factory position. See Figure 7-1 for screw location.

<u>Throttle/Input Adjustment Screw</u>	
Decrease gas Turn Clockwise	Increase gas Turn Counterclockwise



WARNING

Adjustments to the Throttle screw may only be made by a qualified gas technician, while using a calibrated combustion analyzer capable of measuring CO₂ and CO. Failure to follow these instructions may result in serious injury or death.



WARNING

Adjustments to the Throttle screw may only be performed if the gas line pressure is maintained above minimum levels throughout the duration of the test, see Table 7-1. Failure to follow these instructions may result in serious injury or death.

Combustion Calibration - To calibrate burner operation, perform the following procedure using a calibrated combustion analyzer capable of measuring CO₂ and CO from Natural and Propane Gas burning appliances:

1. Operate the unit at the maximum modulation rate, see Table 7-2.
2. Ensure the gas line pressure is maintained within tolerance, see Table 7-1.
3. While at the maximum Gas Input Value, measure the CO₂ and CO; adjust as necessary, using the Throttle Screw, to be within the limits listed in Table 7-1.
4. Operate the unit at the minimum Gas Input Value (Table 7-2). Ensure the combustion remains smooth and CO₂ and CO remain within the limits (Table 7-1). If not, do not adjust further, contact NTI for assistance.

Maximum Modulation Rate – The Trinity Ti boiler is equipped with an electronic burner control that will modulate the firing rate to match the demand placed on the unit. There is no way to force the appliance to operate at the maximum modulation rate; the unit will automatically determine the modulation rate based on the water temperature and the temperature set points. To help obtain the maximum modulation rate the following steps should be taken:

1. Remove the Outdoor sensor wires from the boiler (see Figure 10-1).
2. Change the HI setting to the maximum safe water temperature that the heating system can handle (see Section 11.0).
3. Turn on all heating zones and set thermostats to their maximum setting.

CAUTION

Failure to reconnect the Outdoor Sensor may increase fuel consumption. Failure to return the HI setting to the heating system maximum desired working temperature may result in property damage or excessive fuel consumption.

Alternate method (DHW with Combi or Indirect Fired Water Heater):

1. Turn on several hot water fixtures
2. Set boiler LO setting to 190 (see Section 11.0)
3. If using a Combi boiler the unit will run and stay at high fire until the taps are turned off.
4. If using an indirect hot water tank, allow the tank to cool off before turning the boiler on.

CAUTION

Failure to return the LO setting to the desired working temperature may result in excessive fuel consumption. See Table 10-3 for recommended settings.

Minimum Modulation Rate – Like the maximum modulation rate, there is no way to force the Trinity to operate at the minimum modulation rate. To help obtain the minimum modulation rate follow the steps above for the maximum modulation rate, but slowly reduce the system water flow rate until the minimum modulation rate is achieved. When using the alternate method (DHW with Combi or Indirect Fired Water Heater), reduce the LO setting to the minimum value.

Flue Gas Analysis and Adjustment

Each Trinity Ti is factory set to operate with Natural Gas, for appliances 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 – The Trinity Ti is not equipped with an integrated flue gas test port, flue gases must be sampled at the vent termination or at the condensate drain. When measuring from the termination, ensure the combustion gases are sampled from within the exhaust pipe by inserting the combustion analyzer probe several inches into the exhaust pipe. When measuring from the condensate drain, remove the condensate drain trap and insert the combustion analyzer probe into the condensate drain line while still allowing some flue gases to vent into the room. Perform the flue gas analysis and adjust the gas Throttle/Input Screw as required until CO₂ and CO levels are within acceptable limits, see Table 7-1. If testing is performed via the condensate drain, ensure the flue gases are checked immediately to prevent high levels of Carbon Monoxide from entering the room. Once testing is complete, re-install the condensate drain assembly and check for leaks.

DANGER

Failure to re-install the condensate drain will result in, property damage, serious injury or death.

8.0 BOILER AND HEATING SYSTEMS PIPING

The heat exchanger of the Trinity boiler is designed to attain the highest level of heat transfer in a compact design. To accomplish this, the heating water flows through a series of fin shaped tubes, designed to maximize the heat transfer area. 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.



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 cleaned of all build-up including sludge and scale. All systems, old and new, must be cleaned to remove flux, grease and carbon residue. NTI recommends cleaning the boiler system with “Ferrox F3 Cleaner”. For retrofit applications with heavy limescale and sludge deposits, a heavier duty cleaner may be required; NTI recommends the use of “Ferrox DS-40 System Cleaner”. For information on performing the cleaning, follow the instructions included with the Ferrox DS-40 System Cleaner. See Table 8-1 for list of recommended boiler cleaning products.



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 8-1 Boiler System Cleaners and Corrosion Inhibitors

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

Boiler Water

Pressure - The Trinity boiler is 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 (oxygen) 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 Ti boiler is not approved for operation in an “open system”, thus it cannot be used for direct potable water heating or process heating of any kind.

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

- Water hardness – between 3 and 9 Grains/gal.
- PH – between 7.5 and 9.5.

Treatment - Boiler water must be treated with a corrosion inhibitor. Each Trinity Ti boiler is provided with a bottle of “Ferrox F1 Protector” corrosion inhibitor, adequate to treat a 26.4 gallon (100 liter) heating system to a minimum required concentration of 0.5%. Systems with greater volume will require more inhibitor. For information on performing the treatment, follow the instructions included with the Ferrox F1 Protector. See Table 8-1 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 a 35% concentration of glycol.

Near Boiler Plumbing

Pressure Relief Valve - A 30PSI Pressure Relief Valve is factory supplied with all boilers. Since all Trinity Ti boilers, excluding Ti100's and Ti150's sold in Canada (MAWP=30PSI), have a maximum operating pressure of 145PSI, a pressure relief valve with a higher discharge pressure rating (up to the MAWP of the boiler) may be used as long as the relieving capacity is in excess of the maximum input capacity of the boiler, see boiler rating plate.

The pressure relief valve must be installed at the boiler outlet and in the vertical position, as shown in Figures 8-1(a) through (d), with the drain pipe outlet exiting the side of the pressure relief valve horizontally and elbowing down. If using a higher pressure relief valve, ensure the pressure gauge is sized to display the higher pressure valve.



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



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 – All models come with a factory supplied 30PSI Pressure Gauge. The pressure gauge must be installed at the appliance's outlet prior to any circulators and in the vicinity of the pressure relief valve. See Figures 8-1(a) through (d).

Figure 8-1(a) Ti200 and Ti100-150 US

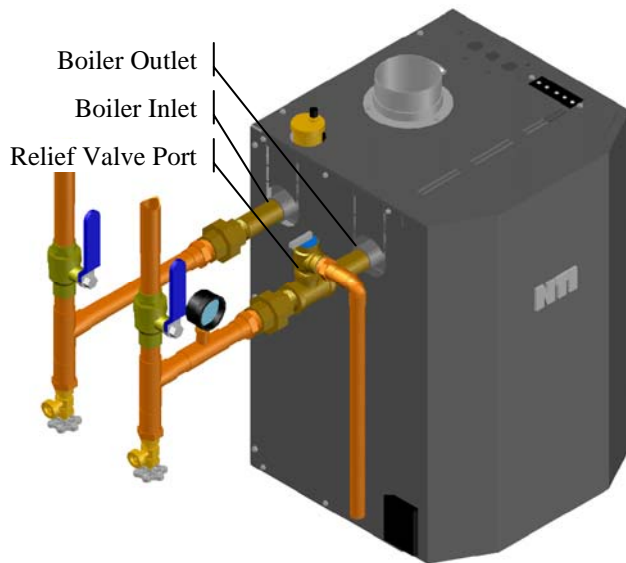


Figure 8-1(b) Ti100-150 Canada

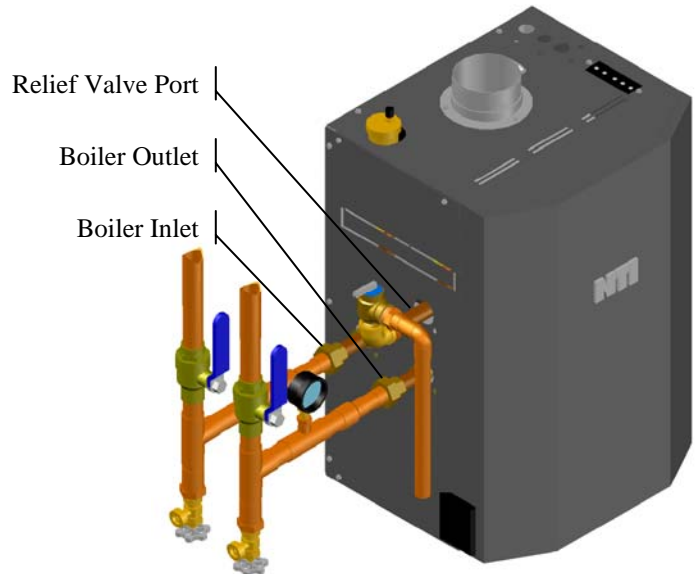


Figure 8-1(c) Ti200 Combi and Ti150 Combi US

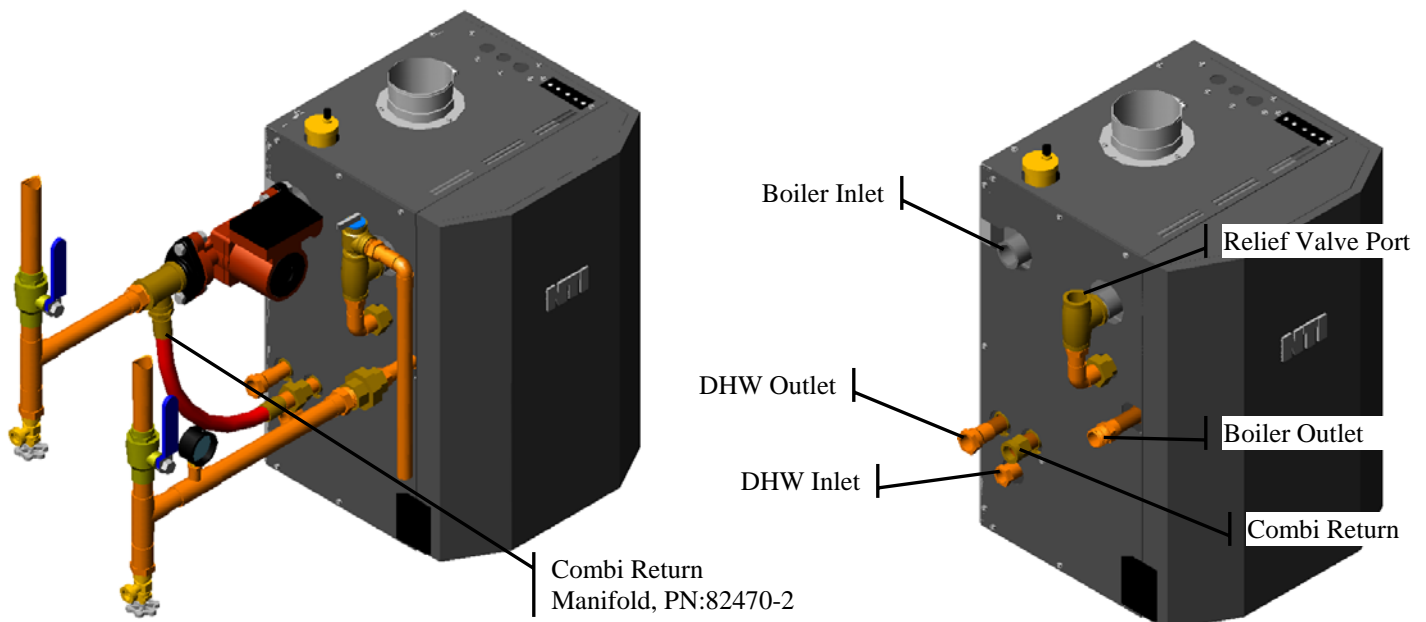
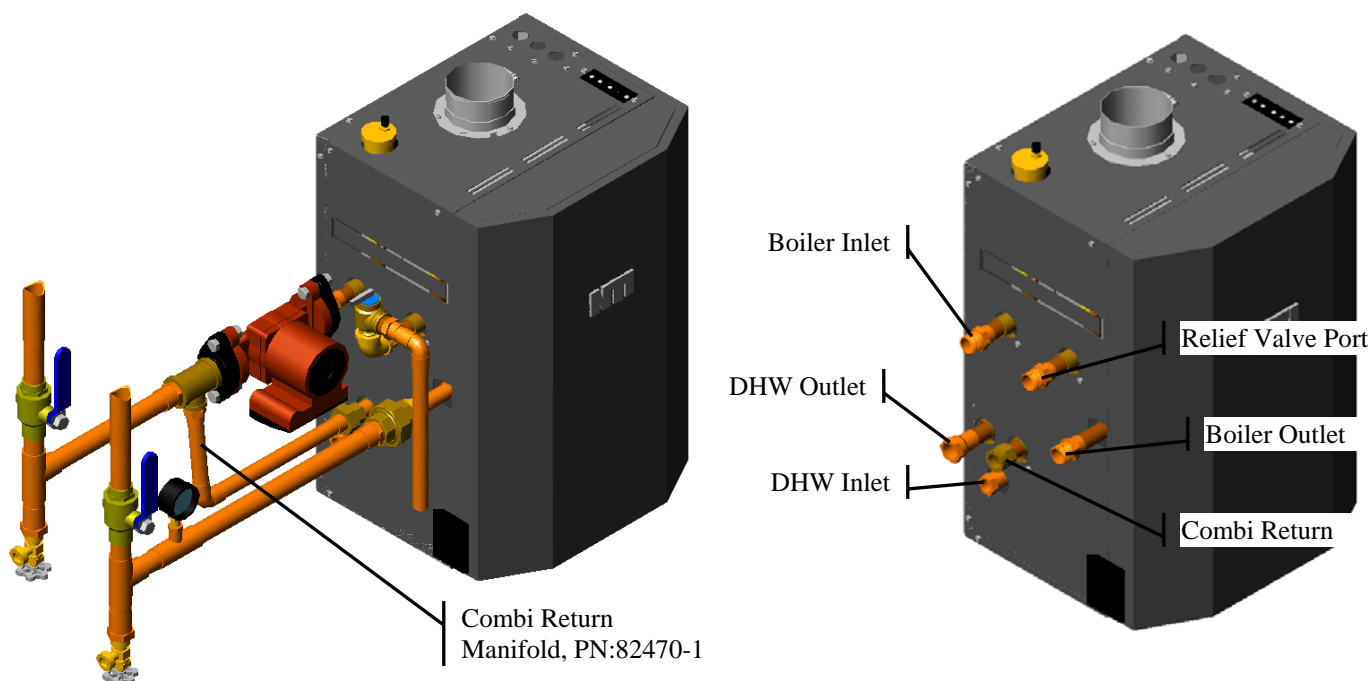


Figure 8-1(d) Ti150 Combi Canada



Boiler System Plumbing

The Trinity Ti boiler uses a low mass heat exchanger that requires a minimum rate of forced water circulation any time the burner is operating (See Table 8-3 for minimum flow rates). To ensure the minimum flow rate is attained, the boiler shall be installed in a “Primary/Secondary” plumbing configuration utilizing “Closely Spaced Tees” to de-couple the Boiler-Primary loop from the System-Secondary loop(s). See the example of Primary/Secondary Loop configuration in Figure 8-2.

System Components – As well as a Primary/Secondary Loop Configuration utilizing closely spaced tees a properly installed system will include the following major components identified in Table 8-2 as a minimum.

Table 8-2 System Major Component Checklist

Factory Supplied Components	Field Supplied Components
<input type="checkbox"/> Pressure Relief Valve (30PSI)	<input type="checkbox"/> Boiler Loop Circulator (Pump C1 in Figure 8-2)
<input type="checkbox"/> Pressure Gauge (30PSI)	<input type="checkbox"/> DHW Loop Circulator (Pump Ap in Figure 8-2, for applications utilizing Indirect Fired Water Heater only)
<input type="checkbox"/> DHW Flow Switch (Combi Only)	<input type="checkbox"/> Central Heat (CH) Loop Circulator(s) (e.g. Zone Circulators in Figure 8-2)
<input type="checkbox"/> Combi Return Manifold, PN:82470-1 (or -2) see Figures 8-1(c) and (d) (Combi Only)	<input type="checkbox"/> Central Air Removal Devices (i.e. Micro Bubbler or Air-Scoop)
	<input type="checkbox"/> Pressure Regulating “Fill Valve”
	<input type="checkbox"/> Backflow Preventor
	<input type="checkbox"/> Expansion Tank

Circulating Pumps – The Trinity Ti boiler is equipped with two 120VAC pump outputs:

1. **PUMP Ap (“Aux. Circ.”)** – Operates during a Domestic Hot Water demand (A-C contact closure).
2. **PUMP C1 (“Circ.”)** – Operates during a Space Heat demand (T-C contact closure). Also operates during a DHW demand on Combi boilers only.

Ensure pumps are oriented as per the manufacturers’ instructions. Wiring of these circulators will depend on the boiler configuration chosen, i.e. Combi or non-Combi boiler, see Section 10.0 for further wiring details.

NOTICE

Circulators responsible for forcing the water flow rate through the boiler must be sized according to Table 8-3, see Figure 8-2 for details.

WARNING

Failure to ensure the minimum water flow rate through the boiler when the burner is on will not only reduce the operating efficiency of the boiler, but may also cause premature failure, overheating and void the warranty. Failure to follow instructions may result in fire, property damage, serious injury or death.

Table 8-3 Minimum Circulator and Pipe Sizes

Model	Restriction Head Loss	Minimum Pipe Size	Min. Flow (GPM)	Max. Temp. Rise	Minimum Primary Loop Pump Size		
					B&G	Grundfos	Taco
100 ¹	7' at 6 GPM	1"	4.5	45°F	NRF-22	UP 15-58	008
150	8' at 7 GPM	1"	6	45°F	PL-30	UP 26-99	0011
200	7' at 10 GPM	1-1/4"	8	45°F	PL-36	UP 26-99	0011
Notes: 1 – Must use pump model specified for Ti150 when using a safety flow switch.							

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 equipped with an automatic air removal device to aid in the purging of air from the boiler during the initial fill. This device is **NOT** intended, nor is it sufficient to remove the air from the system plumbing, even if the air makes it back to the boiler. A strategically located air removal device must be installed in the system.

Low Water Cutoff / Flow Switch – The Trinity Ti boiler is not provided with a LWCO or Flow Switch, however one is to be field installed in any application where the boiler is located above the radiation or where local authorities require it. NTI recommends installing a LWCO or flow switch to prevent the boiler from firing without water in the heat exchanger. When used, Low Water Cut Off and Flow Switch devices must be installed in accordance with the manufacturer's instructions and the following:

- LWCO must be at least 6" above the top of the boiler.
- Flow Switch must be installed in a 1" diameter line directly in series with the boiler at all times. NTI recommends a "McDonnell & Miller" model number "FS8-W".
- The normally open contacts of either a LWCO or Flow Switch must be wired in series with the boiler's 24V limit circuit, see wiring schematic for more details.

⚠ DANGER

Operating the boiler without sufficient water level will result in overheating and may result in property damage, fire, personal injury or loss of life.

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 8-2 and 8-3.

⚠ 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

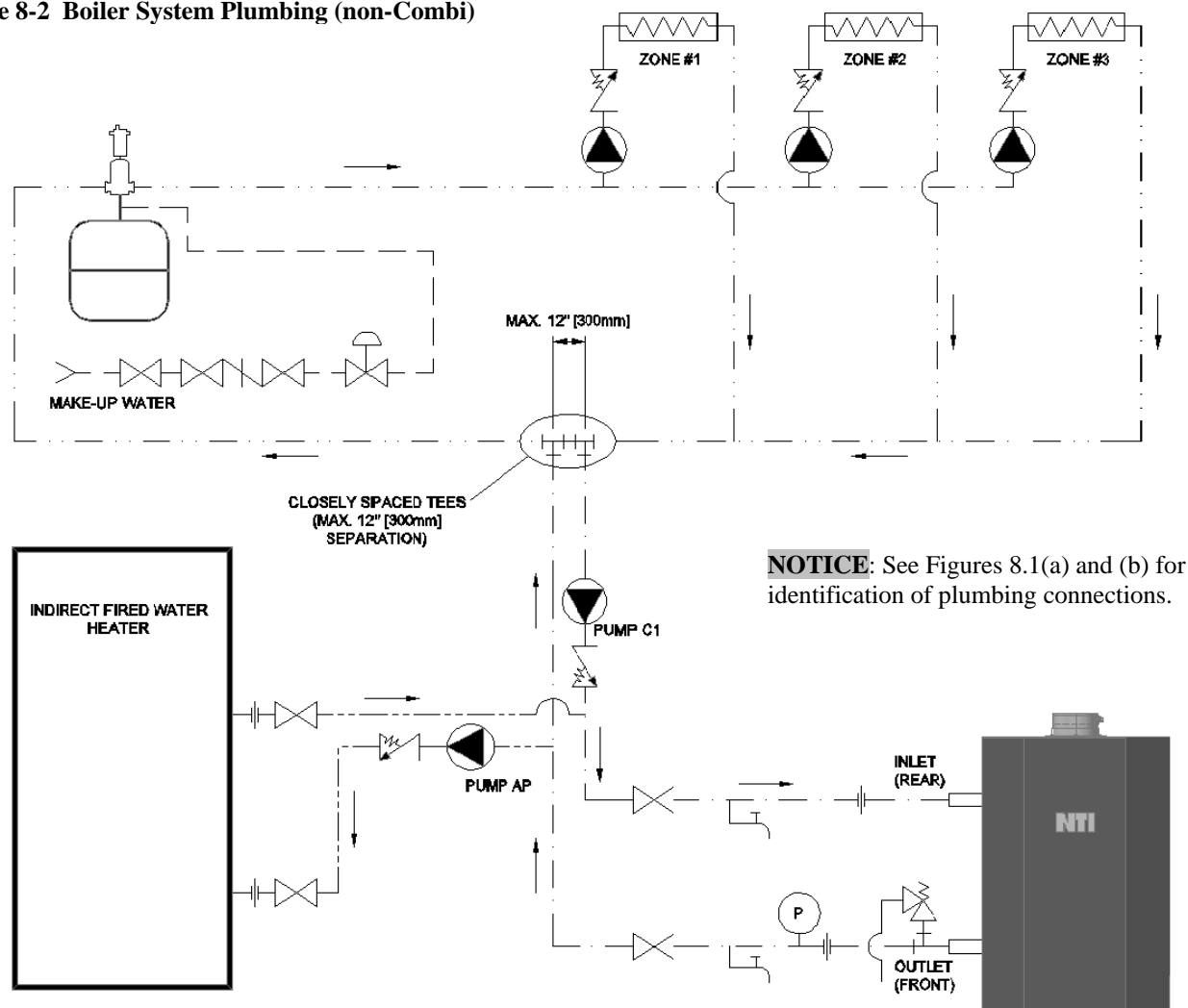
The installation of flow checks, motorized valves or other shutoff devices (other than for the purpose of servicing) are not permitted between the location of the "Closely Spaced Tees" and the expansion tank; see Figures 8-2 and 8-3.

Indirect Fired Water Heater – The indirect fired water heater is in series with the boiler during a demand for DHW. Therefore it is important to use an Indirect Fired Water Heater that has minimal head loss. Indirect fired water heater head loss must not exceed those specified in Table 8-4. See Table 8-3 for minimum circulator specifications.

Table 8-4 Maximum Indirect Fired Water Heater Head Loss (Boiler Side) at Minimum Flow

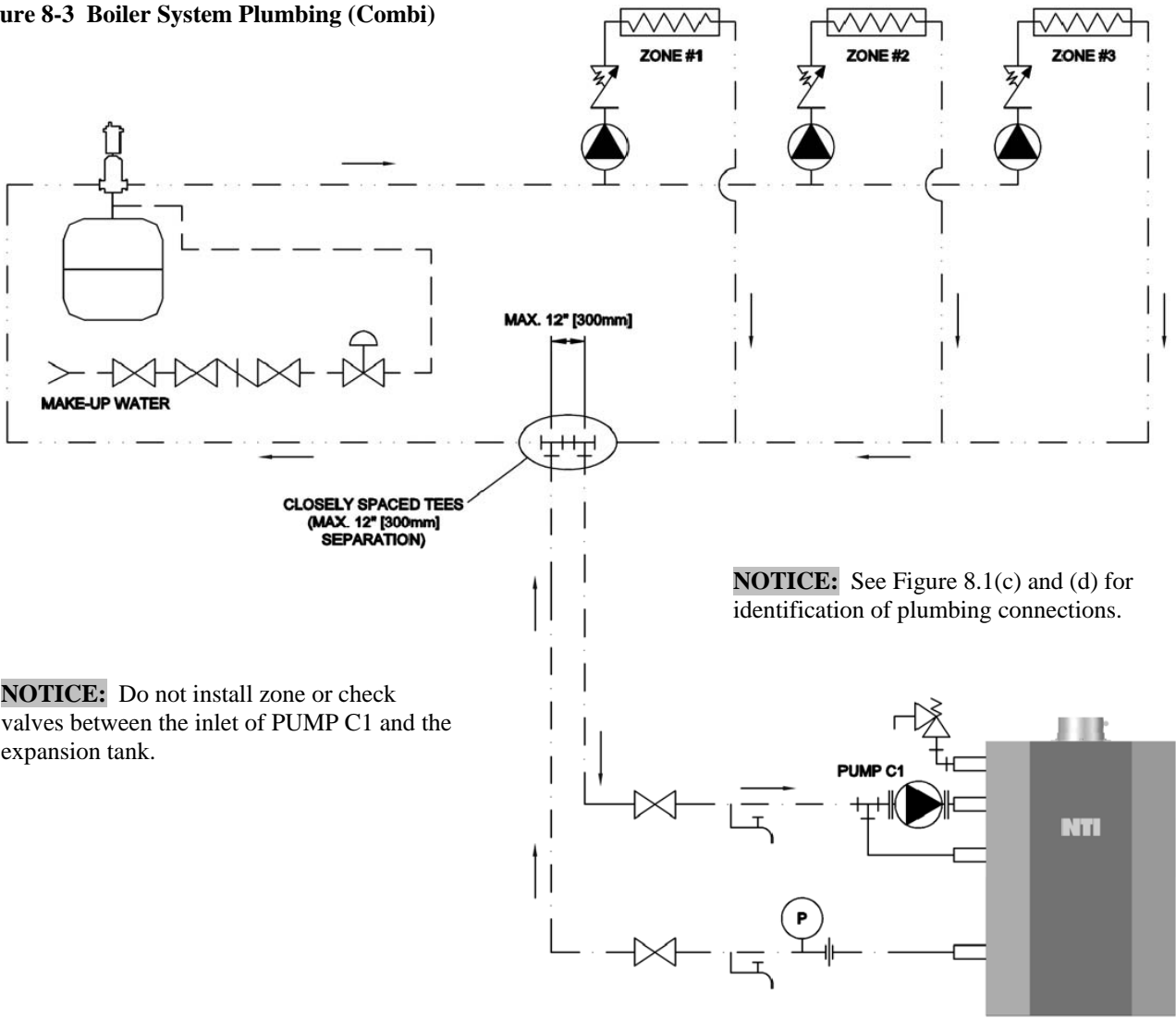
Ti100	Ti150	Ti200
6' at 5 GPM	10' at 6 GPM	14' at 8 GPM

Figure 8-2 Boiler System Plumbing (non-Combi)



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		PRESSURE GAUGE
	SPRING CHECK VALVE		EXPANSION TANK		FLOW DIRECTION
	ZONE LOAD				

Figure 8-3 Boiler System Plumbing (Combi)



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		PRESSURE GAUGE
	SPRING CHECK VALVE		EXPANSION TANK		FLOW DIRECTION
	ZONE LOAD		PUMP FLANGE		ELBOW