

Trinity Lx

Model Numbers: Lx150 - 800

Version Date: 2016-01-27



INSTALLATION AND OPERATION INSTRUCTIONS FOR TRINITY Lx BOILER

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HAZARD SYMBOLS AND DEFINITIONS



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



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



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

CAUTION

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.



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



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Read Before Proceeding

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 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 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



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 15.0 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).



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 Lx 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 models Lx150, Lx150E, Lx200, Lx300, Lx400, Lx500, Lx600, Lx700 and Lx800. 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 User’s 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

Models Lx600-800 are not approved for operation with Propane (LP Gas). Operating these models with Propane will result in property damage, serious injury or death.

DANGER

Read and understand this entire document prior to proceeding with the installation of the Trinity Lx. 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 15 – 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-inlet clear of ice, snow, and other debris may result in property damage, serious injury, or death.

Installer Responsibilities

A qualified installer is a licensed person who has appropriate training and a working knowledge of the applicable codes, regulations, tools, equipment and methods necessary to install a boiler. The Installer assumes all responsibility for a safe installation and that it meets the requirements of the boiler instruction manuals, as well as National and local installation codes. It is also the installer’s responsibility to inform the User/Owner of their obligation with respect to the description under “User Responsibilities”. Failure to follow this warning could result in fire, serious injury, or death.



Failure to use the appropriate Natural to LP Conversion Kit and Orifice when operating the Trinity Lx 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 Lx 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 Lx 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

<u>Model Number</u>	<u>Kit Number</u>	<u>LP Orifice</u>
Lx150-200	82650-1	52 (5.2mm)
Lx300	82650-1	62 (6.2mm)
Lx400	83017-1	62 (6.2mm)
Lx500	84386-1	No Orifice

Boiler Vent / Air-Inlet Piping



The Trinity Lx 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 cannot be met at the time of completion of installation, the owner shall have a period of 30 days to comply with the above requirements; provided, however, that during said 30 day period a battery operated carbon monoxide detector with an alarm shall be installed.
 2. **APPROVED CARBON MONOXIDE DETECTORS** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
 3. **SIGNAGE** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating boiler or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, ***"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS"*** (plate included with boiler).
 4. **INSPECTION** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.
- (b) **EXEMPTIONS:** The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:
1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
 2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.
- (c) **MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM PROVIDED:** When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:
1. Detailed instructions for installation of the venting system design or the venting system components; and
 2. A complete parts list for the venting system design or venting system.
- (d) **MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED:** When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:
1. The referenced "special venting system" instructions shall be included with the boiler 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 boiler or equipment at the completion of the installation.

2.0 INTRODUCTION

Table 2-1 General Specifications

DESCRIPTION	Lx150	Lx150E Lx200	Lx300	Lx400	Lx500	Lx600	Lx700 Lx800
Gas Connection (inches, NPT)	½" (Female)			¾" (Female)		1" (Male)	
Water Connections (inches, NPT)	1" (Female)		1-1/4" (Female)		2" (Female)		
Exhaust Vent Connection (inches)	3		4				6
Air-inlet Connection (inches)	3		4				
Cabinet Height (inches)	29.5		36		43	37	
Cabinet Width (inches)	17						
Cabinet Depth (inches)	18.5		21.5	24	32.5	47.5	63.5
Approximate Weight with water (lbs)	100	125	180	225	320	380	475
Water Content (gallons)	1	1.2	2.1	2.4	3.3	4	5.2
Electrical Rating	120V / 1 Phase / 60 Hz / 12A						
Notes:							
¹ Water connections for Lx150 units sold in Canada are 3/4" NPT and Copper union.							

Table 2-2 Boiler Performance Specifications

DESCRIPTION	Lx150(E)	Lx200	Lx300	Lx400	Lx500	Lx600	Lx700	Lx800
CSA Input Modulation (MBH) ¹	25 – 150 ²	25 - 199	55 - 275	75 - 399	100 - 500	120 - 600	160 - 700	160 - 800
DOE Heating Capacity (MBH) ^{1,3}	136	181	251	375	470	564	658	752
Net I=B=R Rating (MBH) ^{1,3}	118	157	218	326	409	490	572	654
DOE AFUE (%) ³	93.5		93.7	-	-	-	-	-
Combustion Efficiency (%) ³	-	-	-	95				
Thermal Efficiency (%) ³	-	-	-	94				

Notes:
¹ Listed Input and Output ratings are at minimum vent lengths at Sea Level. Numbers will be lower with longer venting and/or altitudes greater than 2000 feet [610 m].

² The maximum input when operating on LP-Gas is limited to 145 MBH for model Lx150.

³ Based on standard test procedures prescribed by the U.S. Department of Energy. Ratings have been confirmed by AHRI.

High Altitude Operation

The Trinity Lx is designed to operate at its maximum listed capacity in installations less than or equal to 2000 ft [610 m] 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 2-3.

Table 2-3 De-rate % for High Altitudes

Elevations	2000 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 over 2000 ft [610 m].					



Combustion – At elevations above 2000 feet, the combustion of the boiler must be checked with a calibrated combustion analyzer to ensure safe and reliable operation. **It is the Installers responsibility to check the combustion and to adjust the combustion in accordance to 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 Lx 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 boiler 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.

Floor Mounting

The Trinity Lx can be mounted directly on combustible flooring, with the exception of carpeting. Installing the boiler on carpeting is not permissible. Ensure the boiler is mounted above any anticipated flood level. Models Lx150-Lx400 come equipped with stationary, low profile legs. Models Lx500-Lx800 include factory supplied/field installed leveling legs. Once the unit is removed from the pallet, thread the leveling legs into the allocated threaded inserts in the bottom of the unit.

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 ft³ or greater, ventilation of the boiler room is not required). Each ventilation air opening must meet the minimum requirements of 1 in² per 1000 Btu/hr, but not less than 100 in². 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.



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 ft³, it is considered a Closet or Alcove. PVC vent pipe and fittings shall not be used within the closet or alcove; only approved CPVC, Polypropylene or Stainless Steel vent pipe and fittings can be used. See Table 4-3 for a list of approved materials.

Indoor Combustion Air – When using Indoor Combustion Air in lieu of Direct Vent air-inlet piping (an option for models Lx500-800), 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(a), (b) and (c), 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. See Table 3-1 for minimum 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 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 3-1 for minimum recommended 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 (Optional)

Lx150-400 models are shipped with wall mounting brackets to provide installers with the option of wall mounting the boiler. Lx500-800 models are not available as a wall mountable unit. Refer to Figures 3-3(a) and 3-3(b) for instructions and illustrations on wall mounting applicable models.

Figure 3-1(a) Closet Installation, Minimum Clearances (Lx150-200)

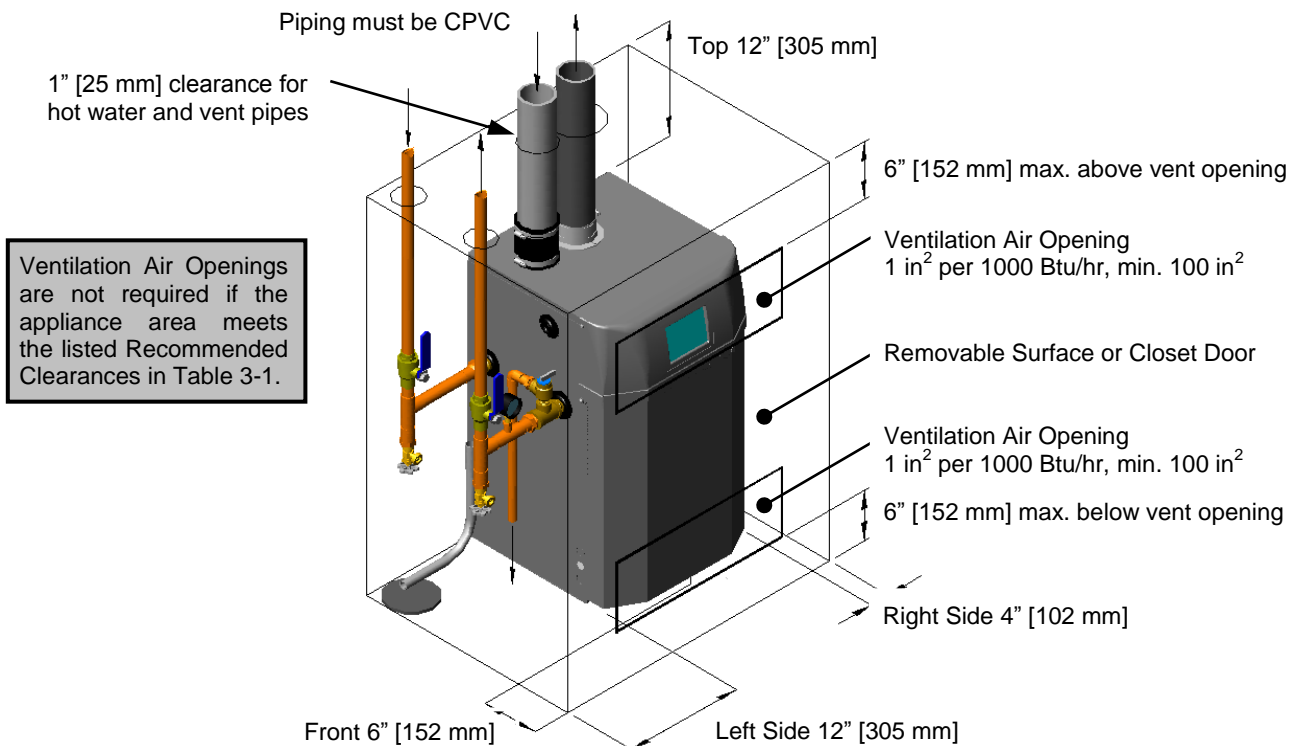
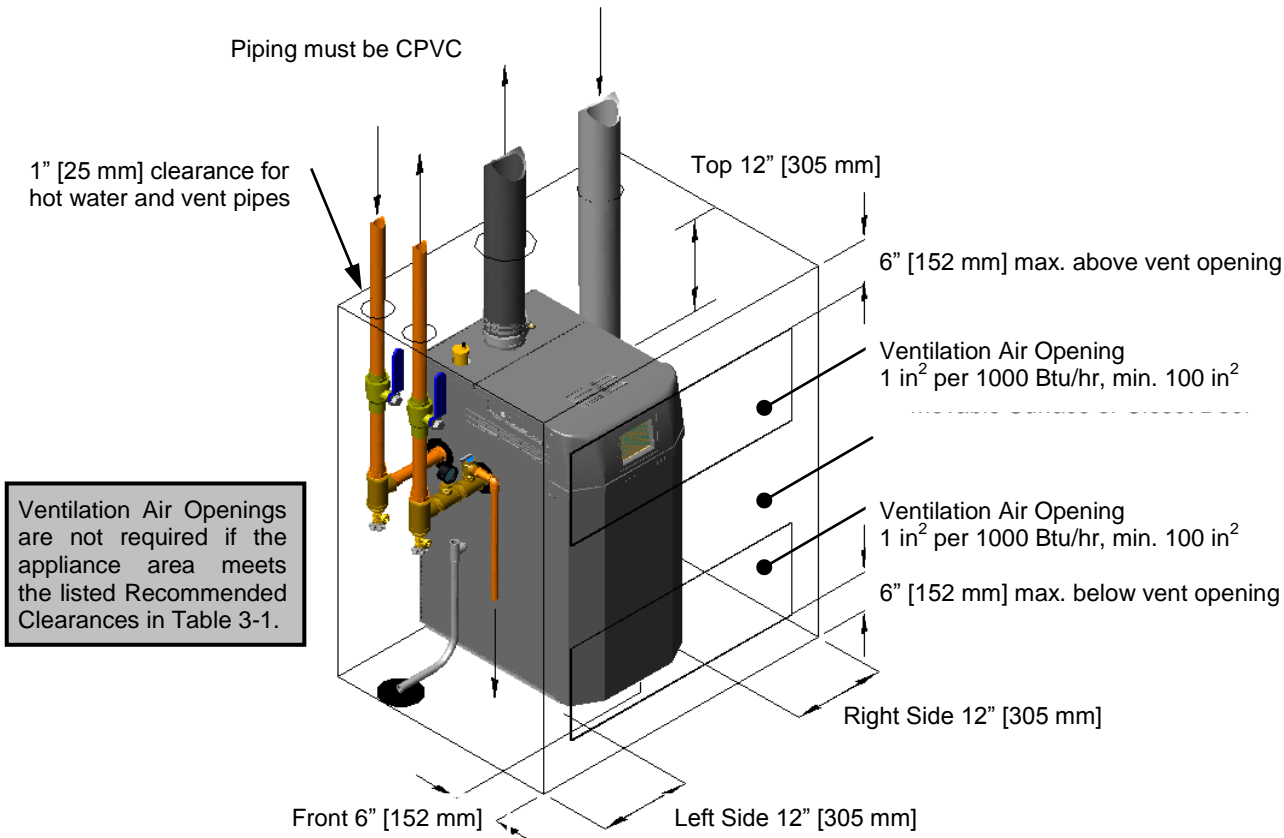


Figure 3-1(b) Closet Installation, Minimum Clearances (Lx300-400)

**WARNING**

Closet/alcove installations in US and Canada require approved **CPVC** vent and air-inlet pipe, fittings, cements and primers (Table 4-3).

Figure 3-1(c) Closet Installation, Minimum Clearances (Lx500-800)

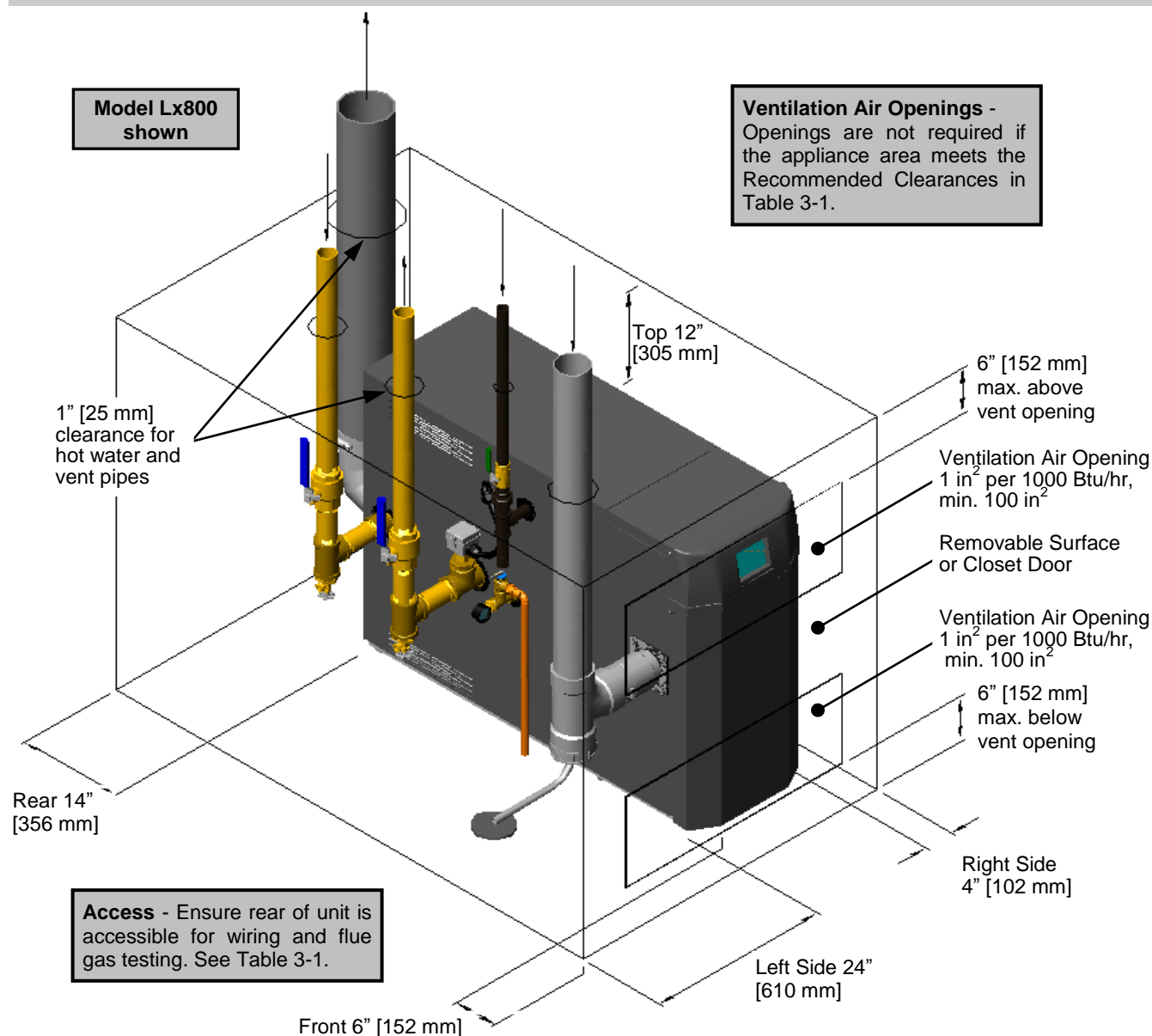


Table 3-1 Minimum Clearances for Installation and Service

Model No.	Clearances	Dimensions - inches					
		Front	Top	Left Side	Right Side	Rear	Flue Pipe
Lx150-200	Minimum	24 ¹	12	12	4	0	1
	Recommended	24	24	24 ²	4	0	1
Lx300-400	Minimum	24 ¹	12	12	12	0	1
	Recommended	24	24	24 ²	12	0	1
Lx500-800 ³	Minimum	24 ¹	12	24	4	14	1
	Recommended	24	24	30	24	18	1

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

² Clearances can be as low as 12" if the right side has a clearance of 24".

³ For models Lx500-800, ensure rear of unit is accessible for wiring and flue gas testing.

Figure 3-2(a) Wall Mounting Installations (Lx150-200)

- ❶ Remove the upper wall mount bracket from the back of the boiler.
- ❷ Secure the upper wall mount bracket to a solid wall using field supplied lag screws (anchors when mounting on a concrete wall) that are adequate to support the weight of the boiler. Ensure the bracket is mounted in the level position. Refer to Table 2-1 Specifications for boiler weight.
- ❸ Mount the boiler to the bracket by aligning the slots in the back of the boiler with the hooks protruding from the wall bracket. The top of the slots must rest at the bottom of the groove in the hooks of the wall mount bracket.
- ❹ Pull the bottom of the unit away from the wall to allow the installation of the lower wall mount bracket (included with boiler). The bracket will snap into place using the slots provided in the bottom of the unit (ensure the snaps lock into place, once installed the bracket should not be easily removed).

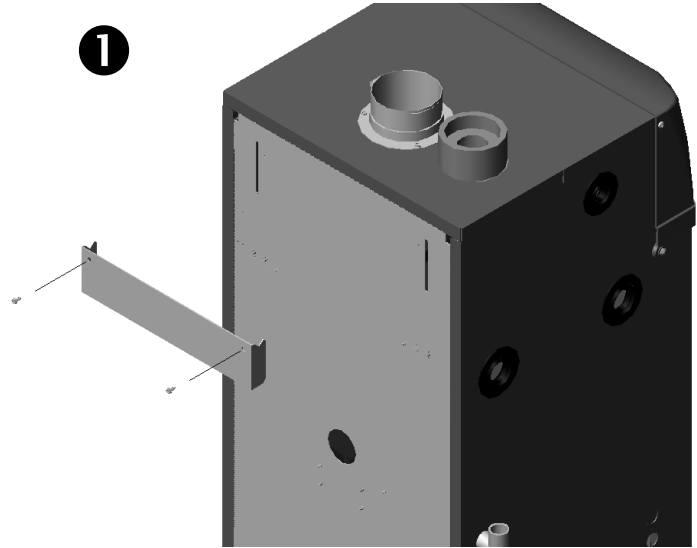
⚠ WARNING

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

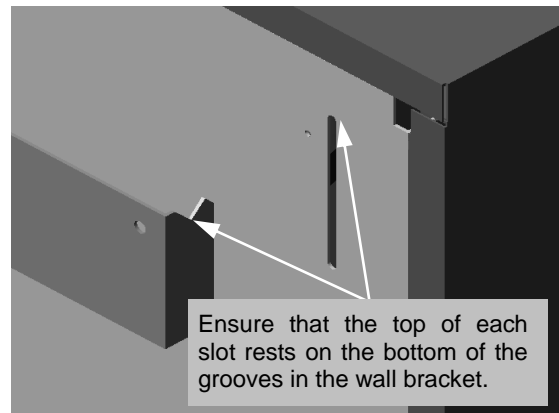
⚠ CAUTION

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

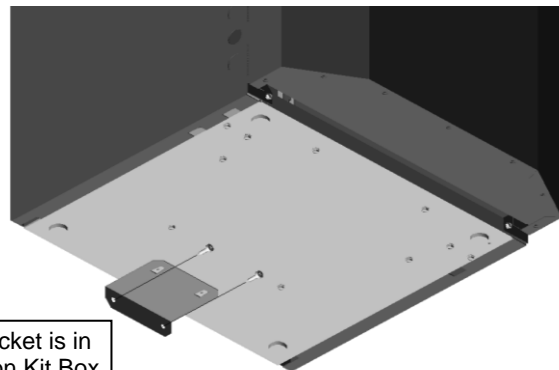
❶



❸



❹



Bottom Bracket is in Lx Installation Kit Box

Figure 3-2(b) Wall Mounting Installations (Lx300-400)

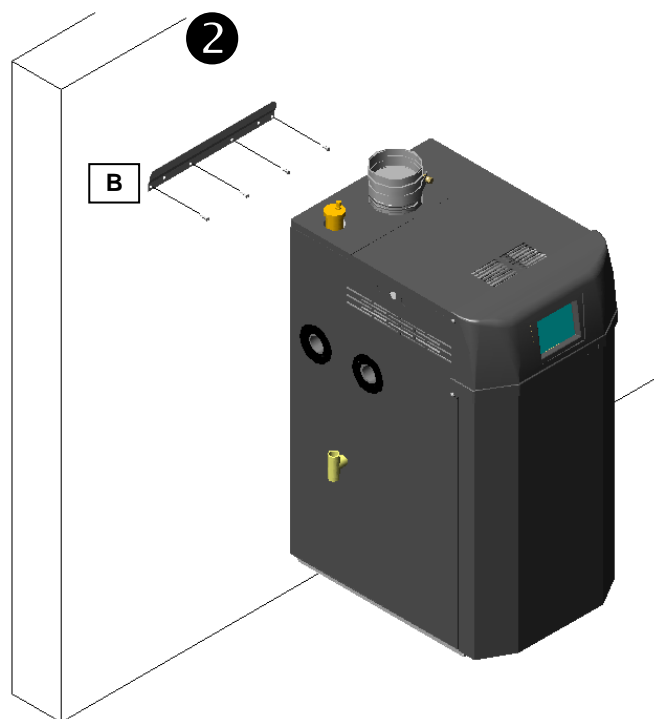
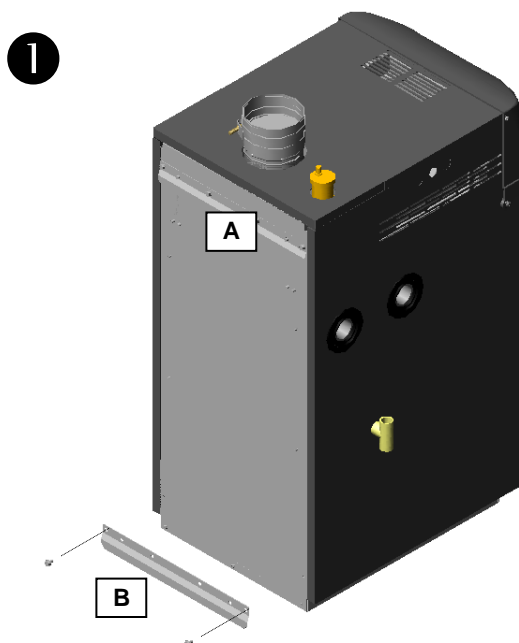
- ❶ While leaving the upper bracket intact (A), remove the wall mount bracket attached to the bottom-back of the boiler (B). Save the mounting hardware for Step 4.
- ❷ Secure the wall mount bracket, removed from the bottom of the boiler in Step 1, to a solid wall using field supplied lag screws (anchors when mounting to a concrete wall) that are adequate to support the weight of the boiler (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 boiler 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 boiler is resting securely on the upper bracket, secure the bottom bracket to the underside of the boiler using the mounting hardware removed in Step 1; then, anchor the bottom bracket to the wall as shown.

WARNING

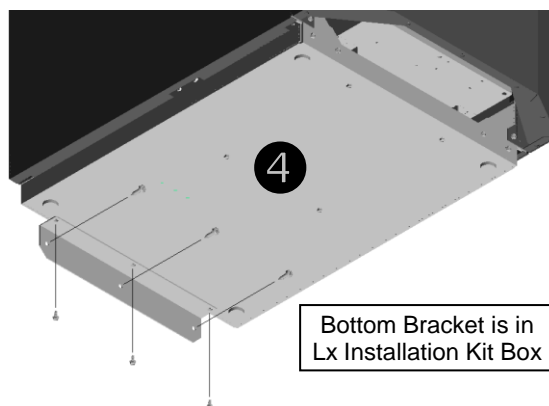
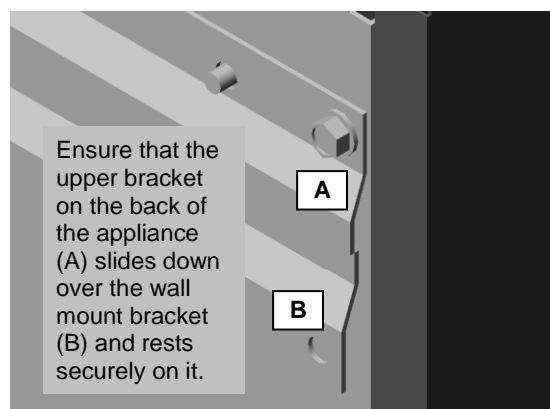
Failure to follow instructions may result in fire, serious injury, or death.

CAUTION

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



❸



4.0 GENERAL VENTING

The Trinity Lx 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.



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

Removing an Existing Boiler from Common Venting System



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



When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the remaining appliances 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.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

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 appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan.
4. Place in operation the boiler being inspected. Follow the 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 appliance 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 appliance to their previous condition of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with 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 (Mandatory for models Lx150-400)

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 (Optional for models Lx500-800)

When the installation uses Indoor Combustion Air (i.e. piping is not directly connecting the boiler 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.

NOTICE

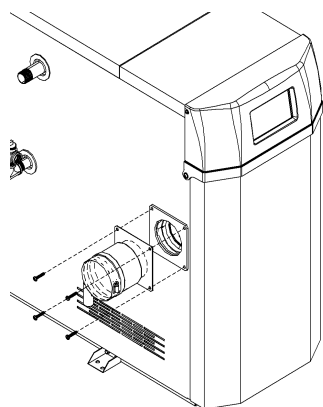
Controller RPM Adjustments – To avoid the potential boiler lockouts due to wind and static pressure differences, the Lightoff and Minimum Modulation RPM Rates must be adjusted as per Figures 4-11 and 4-21 in Appendix A when using indoor combustion air.

Air Filter Kit (P/N 84093) – When using indoor combustion air (non-Direct Vent), it is highly recommended to use the optional Air Filter Kit (P/N 84093) to limit the amount of dust that enters the combustion system. The Filter Kit can be installed on boiler models Lx500-800, as illustrated in Figure 4-1 (comprehensive installation instructions are provided with the Filter Kit).

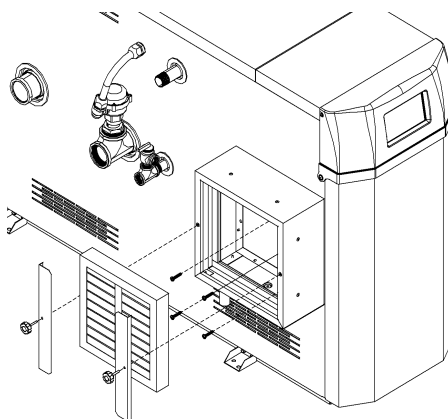
NOTICE

Venting Limitation – When using the Air Filter Kit on models Lx500-600, the maximum equivalent exhaust vent length is limited to 30 ft. with 4” piping, or 90 ft. with 6” piping; see warning below Table 4-5.

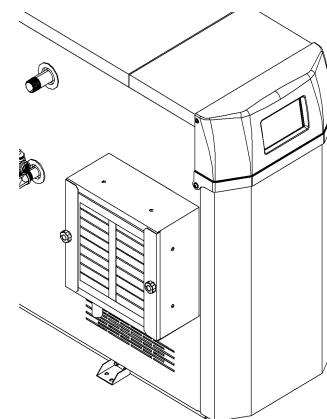
Figure 4-1 Installation of Optional Air Filter Kit (P/N 84093)



1 Remove factory appliance air-inlet adapter; keep screws from installation of filter kit



2 Secure filter kit using factory screws removed in step 1. Reuse the factory gasket.



3 Secure the filter in place with the brackets and knurled screws provided in the filter kit.

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-intake piping:

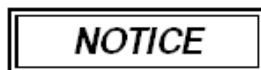
Table 4-1 Corrosive Products and Contaminant Sources

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



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.



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

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.



WARNING

Spark Igniter Cable - Maintain a minimum 2" separation between spark igniter circuit and conductors. Failure to follow instructions may result in component failure, injury or death.

- 1) Working with the power turned off to the boiler, completely install the vent and air-inlet 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) Disconnect electrical leads to the Hot Surface or Spark Igniter. Ensure the cables are placed in a fashion where they will not arc to ground or other conductor. Refer to warning regarding Spark Igniter Cable.
- 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 electrical leads to the Igniter.

Near Boiler Vent/Air-inlet Piping

Each Trinity Lx is equipped with a short piece of approved CPVC vent pipe (see Table 4-2 CPVC Vent Pipe Transition Piece). Insert one end into the boiler flue outlet adapter and cement the other to 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 4-5.



Gasket Seating - Improper seating can cause leakage and eventual failure of the sealing gasket. Failure to follow these instructions may result in serious injury or death.



PVC Exhaust Venting – **DO NOT** insert PVC pipe directly into the boiler 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 boiler adapter, resulting in property damage, serious injury or death.

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

Model No.	CPVC Vent Pipe Size	CPVC Transition Vent Pipe Length	Full Insertion Depth
Lx150-200	3"	Minimum 5" [127 mm]	2-7/8" [73 mm]
Lx300-600	4"	Minimum 4" [100 mm]	1-7/8" [48 mm]
Lx700-800	6"	Minimum 6" [152 mm]	2-1/2" [63 mm]



Polypropylene or Stainless Steel Venting – When using Polypropylene or Stainless Steel piping, the appropriate boiler adapters must be used to transition the boiler 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.

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

Model No.	Vent Material	Venting Brand	Adapter Part No. ^{1,2}
Lx150-200	Polypropylene	DuraVent – PolyPro	300150
		Centrotherm - InnoFlue	ISANY0303
	Stainless Steel	DuraVent – FasNSeal	300715
Lx300-600	Polypropylene	DuraVent – PolyPro	300151
		Centrotherm - InnoFlue	ISAA0404
	Stainless Steel	DuraVent – FasNSeal	303631
Lx700-800	Polypropylene	DuraVent – PolyPro	810004281
		Centrotherm - InnoFlue	ISAA0606
	Stainless Steel	DuraVent – FasNSeal	810005231

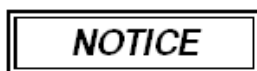
Notes:

¹ Listed boiler adapters are only approved for use with the respective venting brand; i.e. a PolyPro boiler adapter shall not be used with InnoFlue venting.

² PolyPro and FasNSeal boiler adapters are available from DuraVent (1-800-835-4429 or www.duravent.com); InnoFlue boiler adapters are available from Centrotherm Eco Systems (1-877-434-3432 or www.centrotherm.us.com).



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



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

Figure 4-2(a) Near Boiler Venting (CPVC)

Models Lx150-200

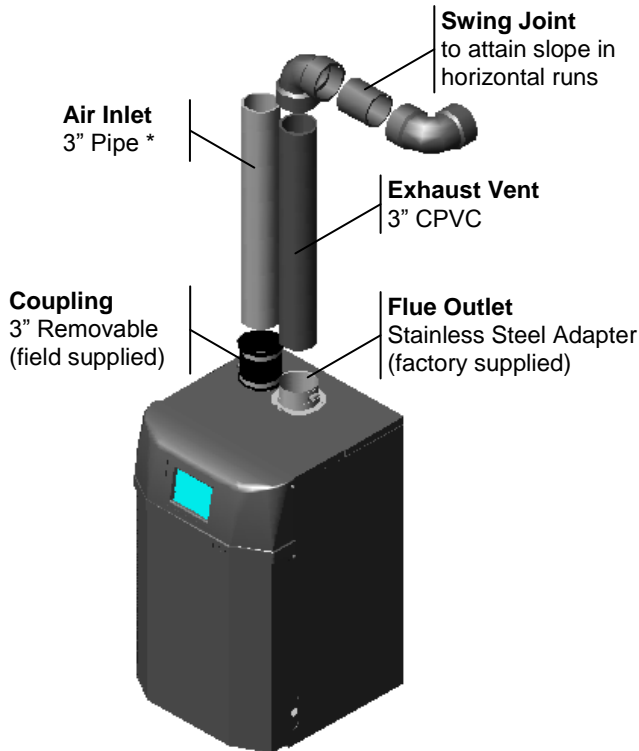


Figure 4-2(b) Near Boiler Venting (PVC)

Models Lx150-200

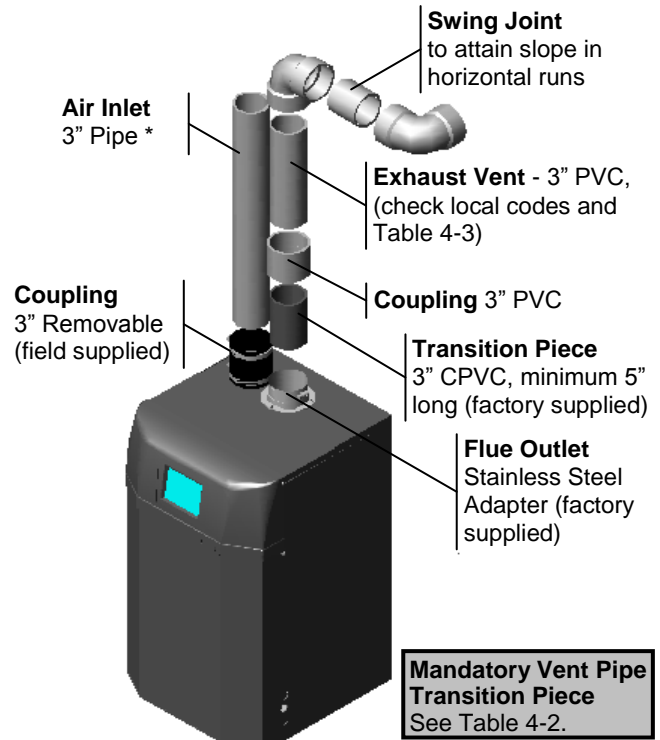


Figure 4-3(a) Near Boiler Venting (CPVC)

Models Lx300-400

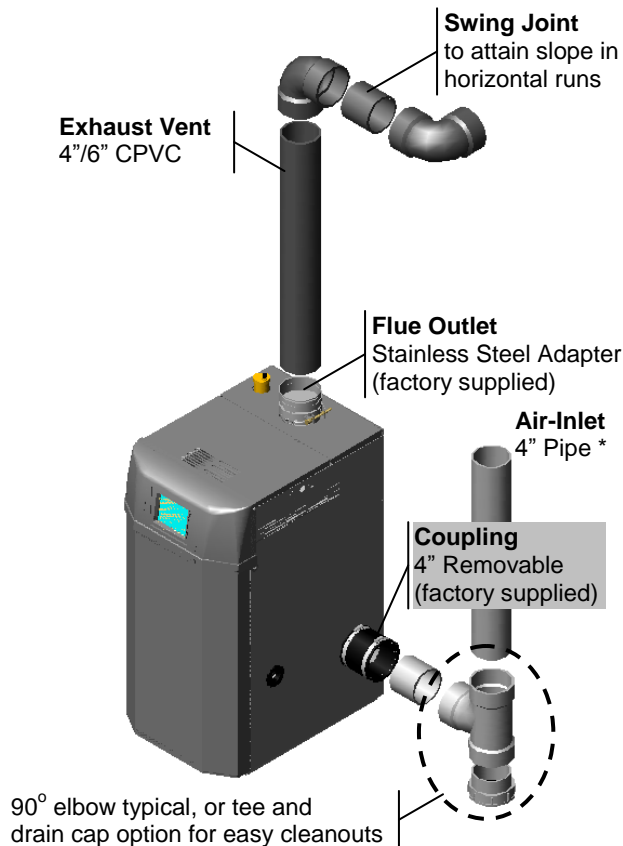
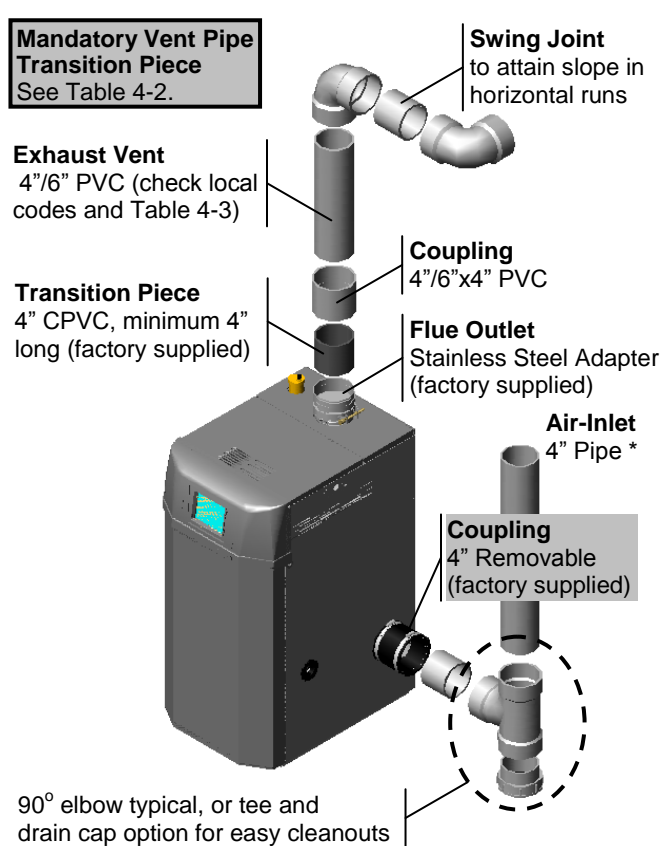
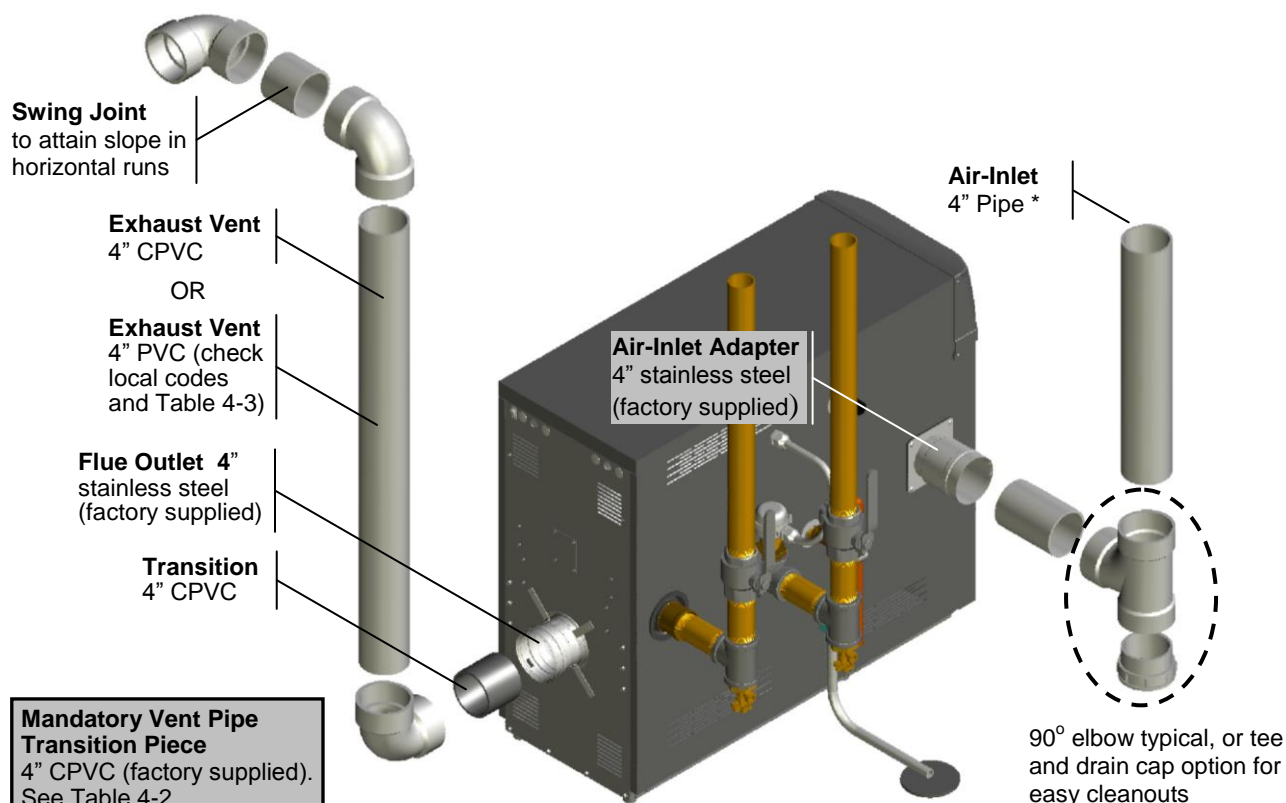
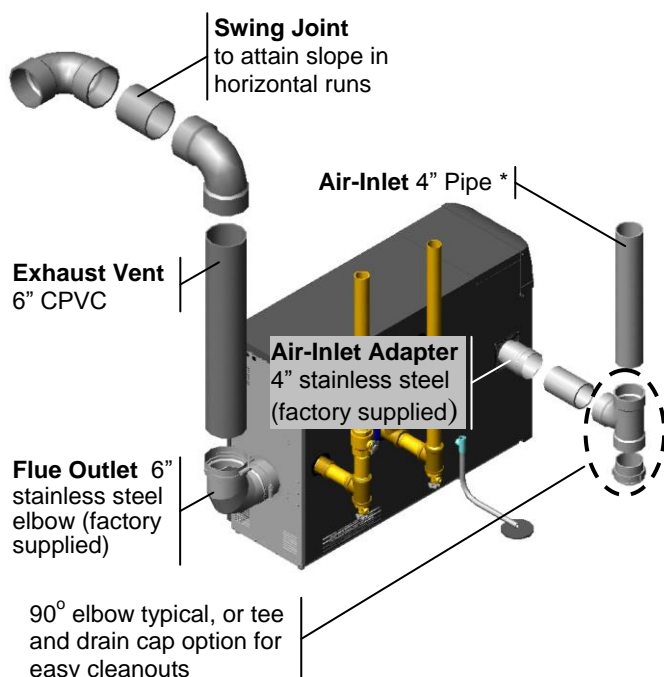
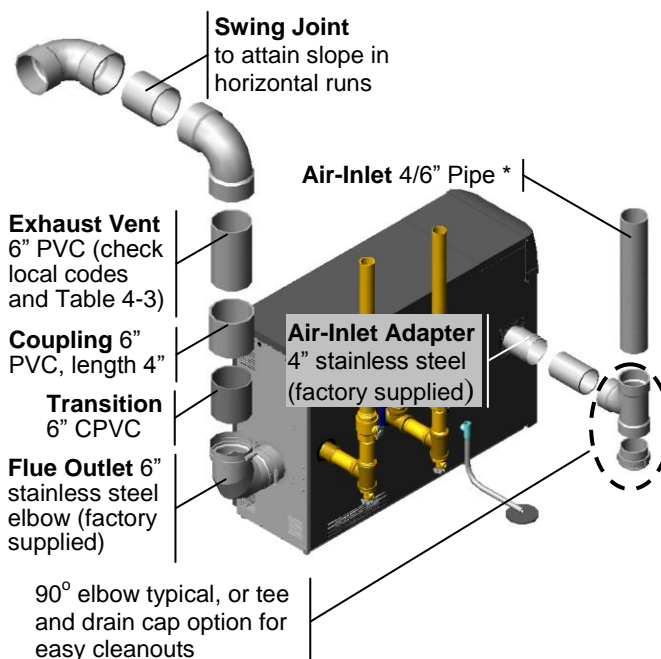


Figure 4-3(b) Near Boiler Venting (PVC)

Models Lx300-400




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

Figure 4-4(a) Near Boiler Venting (CPVC/PVC)
Models Lx500-600

Figure 4-5(a) Near Boiler Venting (CPVC)
Models Lx700-800

Figure 4-5(b) Near Boiler Venting (PVC)
Models Lx700-800
Mandatory Vent Pipe Transition Piece
6" CPVC (factory supplied). See Table 4-2.


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

Vent/Air-inlet Pipe Material**Table 4-4 Acceptable Vent and Air-inlet Pipe Material**

Items ¹	Materials ^{2, 3}	Installation Standards		 WARNING All Vent and Air-inlet materials installed on gas fired appliances in CAN/US must meet the Standards listed in Table 4-4. Failure to comply could result in fire, serious injury or death.
		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		
	AL29-4C	UL-1738		
	Polypropylene (PP)	-		
Pipe Cement	PVC	ANSI/ASTM D2564		
	CPVC	ANSI/ASTM F493		
Primers	PVC / CPVC	ANSI/ASTM F656		

Notes:
¹ Refer to Table 4-5 for Allowable Vent and Air-inlet Pipe Sizes and Lengths.
² PVC venting (exhaust and air-intake) is not permitted within the Closet/alcove of a Closet/alcove installation.
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 boiler supply water temperatures greater than 140°F (60°C) must use ULC S636 CPVC, PP or AL29-4C.

**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 and Air-inlet Pipe Length Determination

Use Table 4-5 to determine the maximum pipe length that can be used. The table calculates sweep, 90° elbows, and 45° elbows at 5 equivalent feet each. Note: models Lx150-200 have limitations when operating with Propane Gas (LP).

Example: An Lx200 can be installed with 105 equivalent feet of air-inlet piping and 105 equivalent feet of exhaust vent piping when operating with Natural Gas. When operating with Propane Gas (LP), the maximum length of each the exhaust vent and air-inlet pipe is limited to 50 equivalent feet (3" diameter pipe).

NOTICE

The length of one vent pipe (air-inlet or exhaust) may not exceed the length of the other vent pipe by more than 20 equivalent feet.

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

Model	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
Lx150-200	3"	LP	50	45	40	35	30	25	20	15	10	5
	3"	NG	105	100	95	90	85	80	75	70	65	60
	4"	NG & LP	105	100	95	90	85	80	75	70	65	60
Lx300-400	4" or 6"	NG & LP	100	95	90	85	80	75	70	65	60	55
Lx500	4" or 6" ³	NG & LP	100	95	90	85	80	75	70	65	60	55
Lx600	4" or 6" ³	NG ²	100	95	90	85	80	75	70	65	60	55
Lx700-800	6" ¹	NG ²	100	95	90	85	80	75	70	65	60	55

Notes:

¹ Only 6" exhaust vent is permissible for models Lx700-800. Air-inlet pipe can be 4" or 6" (6" is highly recommended).

² Models Lx600-800 operate with Natural Gas only.

³ Models Lx500-600 are limited to 30 ft. of 4" or 90 ft. of 6" exhaust venting when using the Air Filter Kit (P/N 84093).

WARNING

Air Filter Kit venting restrictions - Models Lx500-600 are limited to 30 equivalent feet of 4" (or 90 equivalent feet of 6") exhaust vent when using the optional Air Filter Kit. When transitioning from 4" to 6", the 4" venting used must be counted 3 times to convert to an equivalent length in 6".

Example: An application uses one 90° elbow and 5 feet of 4" venting before converting to 6"; therefore, the 4" venting has an equivalent length of 30' [(5' + 5') x 3] of 6" venting; thus allowing an additional 60' equivalent of 6" venting (Note: Example is only true with Lx500-600 models using the optional Indoor Combustion Air Kit).

Termination Options – Direct Vent Installation

The venting system of the Trinity Lx may be terminated using field supplied piping to construct a “Two-Pipe” termination, see Figures 4-6(b), 4-7(a), 4-7(b) and 4-8(a); alternatively the venting may be terminated using a factory kit selected from Table 4-6.

Kits certified with the Trinity Lx are listed in Table 4-6 and available from IPEX, DuraVent, Centrotherm 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	3"	196985 (NTI P/N 84357)	4-9	PVC/CPVC ⁷	✗	✓
	4"	196986 (NTI P/N 84358)				
IPEX Concentric (Wall/Roof) ^{5,6,7,8}	3"	196116 (NTI P/N 82666)	4-9(b), 4-10(b)	PVC/CPVC ⁷	✓	✓
		197117				
	4"	196021 (NTI P/N 84355)				
		197021				
DuraVent - PolyPro Concentric (Wall)	3"	3PPS-HK	4-9(d)	PVC/CPVC/PP	✗	✓
	4"	4PPS-HK				
DuraVent - PolyPro Concentric (Roof)	3"	3PPS-VK	4-10(c)	PVC/CPVC/PP	✓	✗
	4"	4PPS-VK				
Centrotherm – InnoFlue (Flush Mount)	3"	ISLPT0303	4-9	PVC/CPVC/PP	✗	✓
Centrotherm – InnoFlue Concentric (Wall) ⁹	3"	ICWS3513 & ICTC0335	4-9(d)	PVC/CPVC/PP	✗	✓
		ICWT352 & ICTC0335				
	4"	ICWS4639 & ICTC0446				
Centrotherm – InnoFlue Concentric (Roof) ⁹	3"	ICRT3539 & ICTC0335	4-10(c)	PVC/CPVC/PP	✓	✗
	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 (3 in. vent screen P/N 196051 – each sold separately).

⁷ IPEX Low Profile and Concentric kits (excluding P/N 197009) 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 ICTC0335 or ICTC0446.

¹⁰ 3" Vent Termination Kits may only be used with models Lx150-200.



WARNING Models Lx300-800 are not approved for use with any of the 3" vent termination kits; only 4" vent termination kits, listed in Table 4-6, are acceptable.



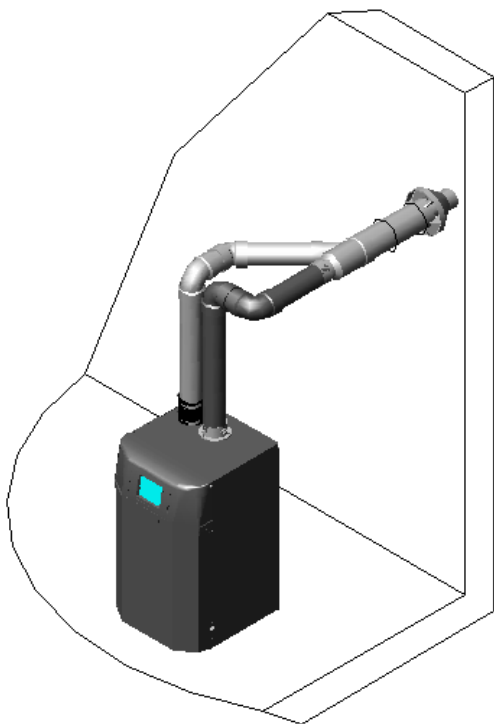
IMPORTANT **PVC In Canada** - Authorities in some jurisdictions may not allow the use of any PVC venting materials with condensing boilers; check with the local safety inspector to verify compliance prior to installing a PVC Concentric Vent Kit with a Trinity Lx.

IMPORTANT

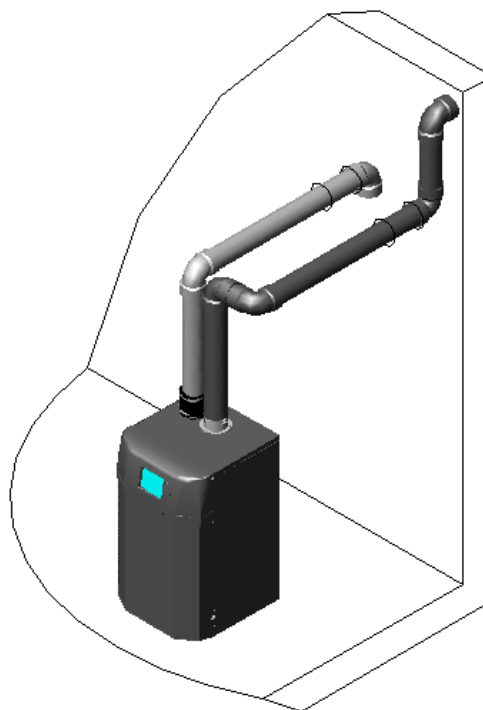
Sidewall Termination - Due to potential moisture loading (build-up) along the exterior wall, sidewall venting may not be the preferred venting option. Refer to Figures 4-8 and 4-10 for roof top venting options.

Sidewall Termination Examples – Direct Vent Installation
Figure 4-6(a) Concentric Sidewall Termination

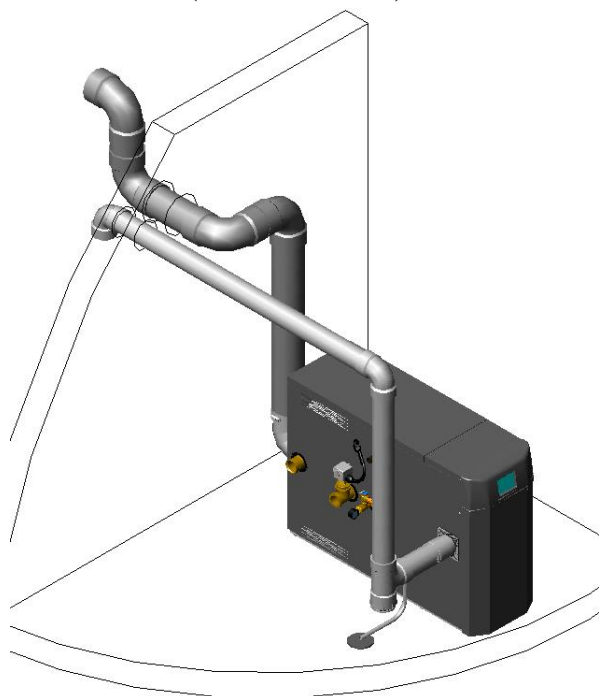
(Lx200 Illustrated)


Figure 4-6(b) Two-Pipe Sidewall Termination

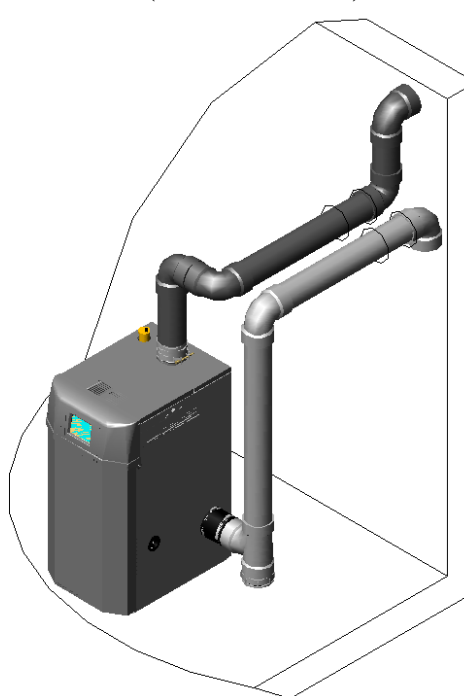
(Lx200 Illustrated)


Figure 4-7(a) Two-Pipe Sidewall Termination

(Lx800 Illustrated)


Figure 4-7(b) Two-Pipe Sidewall Termination

(Lx400 Illustrated)





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.

Roof Termination Examples – Direct Vent Installation

Figure 4-8(a) Two-Pipe Roof Termination

(Lx200 Illustrated)

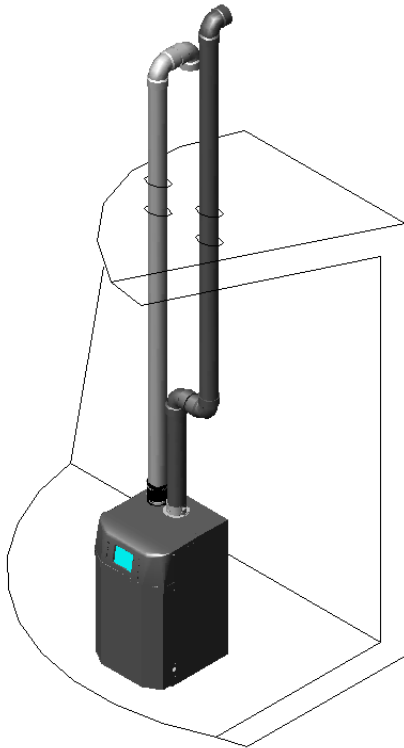
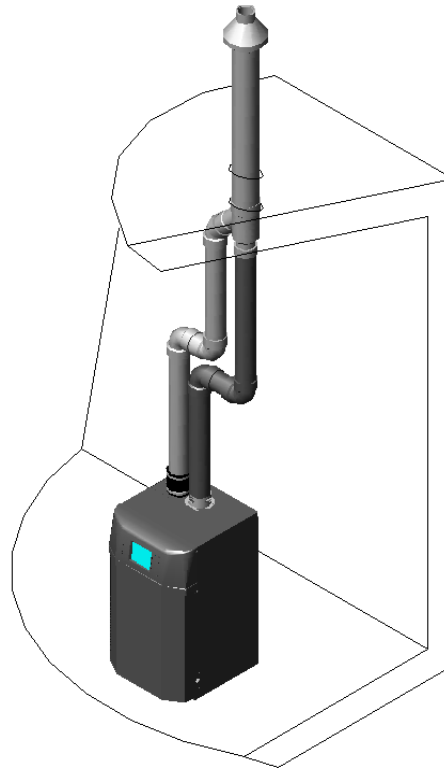


Figure 4-8(b) Concentric Roof Termination

(Lx200 Illustrated)



Sidewall Termination Details – Direct Vent Installation

Figure 4-9(a)

Two-Pipe Termination (Sidewall)

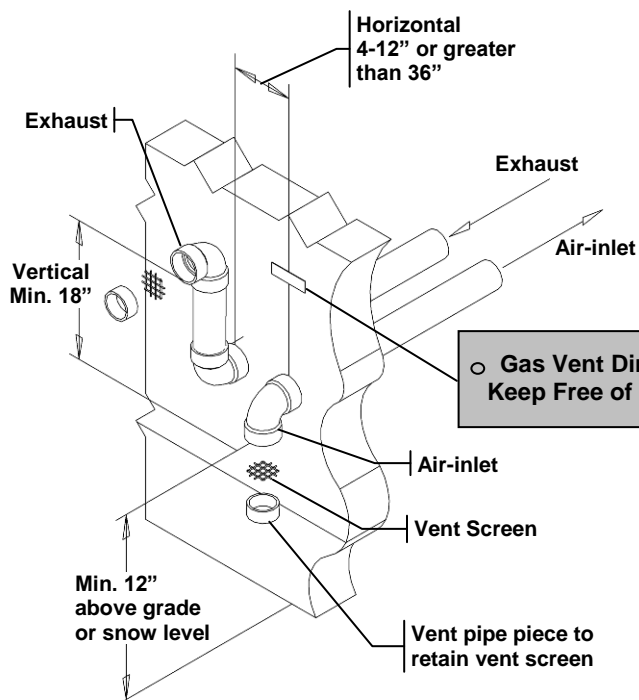


Figure 4-9(b)

IPEX Concentric Termination (Sidewall)



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

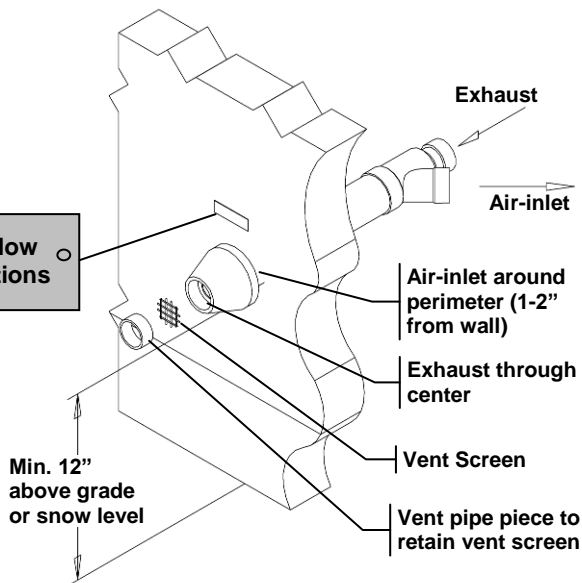


Figure 4-9(c)

Low Profile Termination (Sidewall)



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

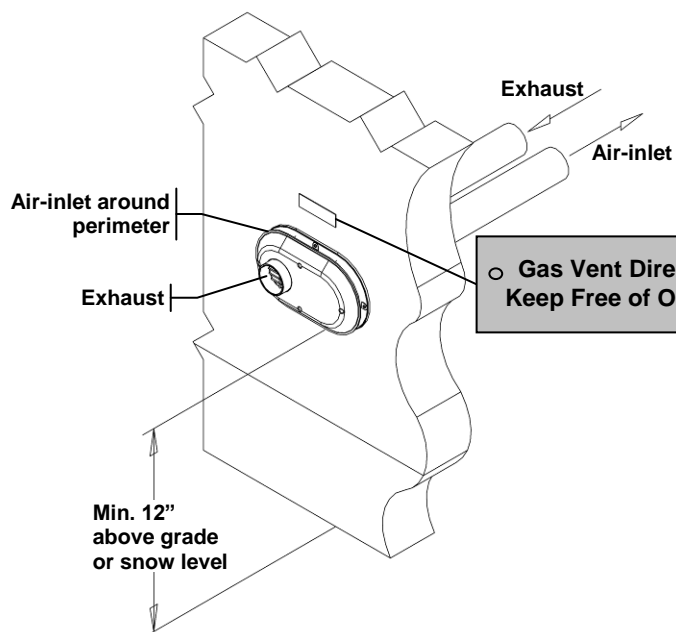
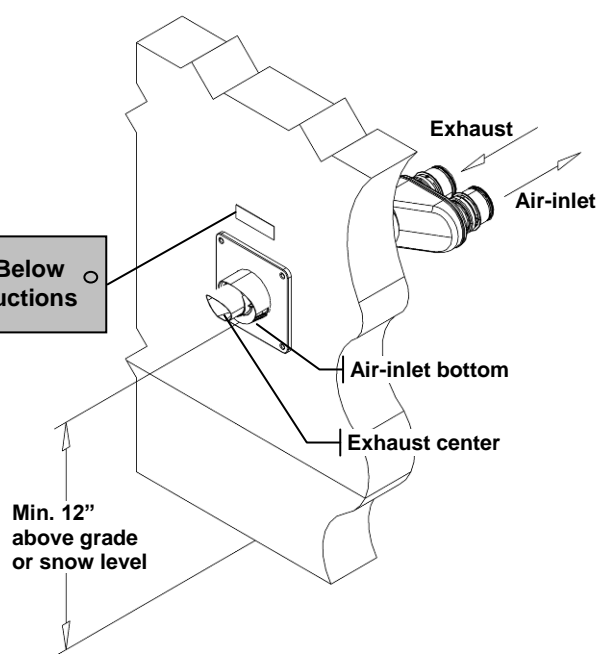


Figure 4-9(d)

PolyPro / InnoFlue Termination (Sidewall)



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



Roof Termination Details – Direct Vent Installation

Figure 4-10(a)

Two-Pipe Termination (Roof)

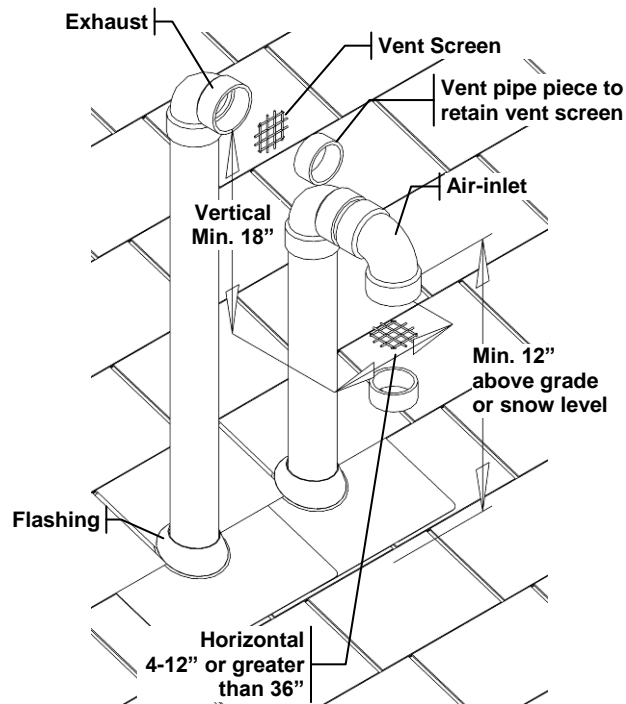


Figure 4-10(b)

IPEX Concentric Termination (Roof)



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

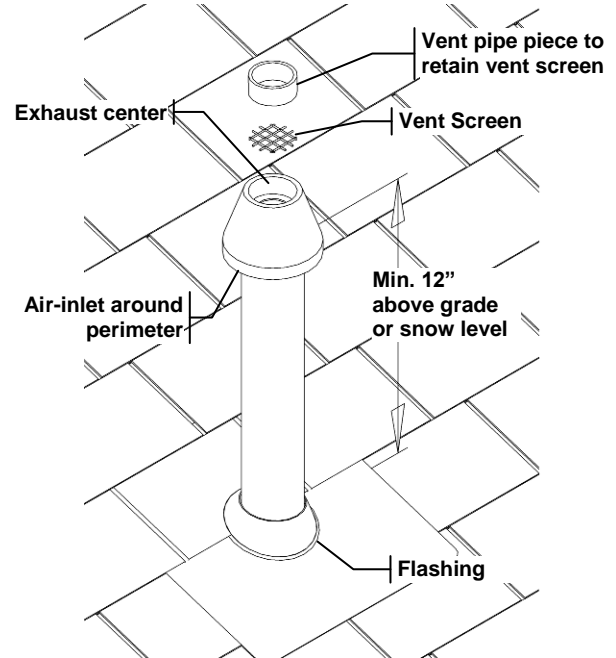


Figure 4-10(c)

PolyPro / InnoFlue Termination (Roof)



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

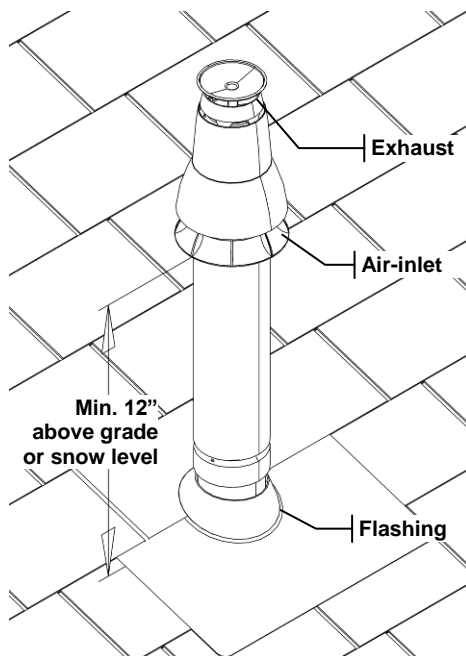
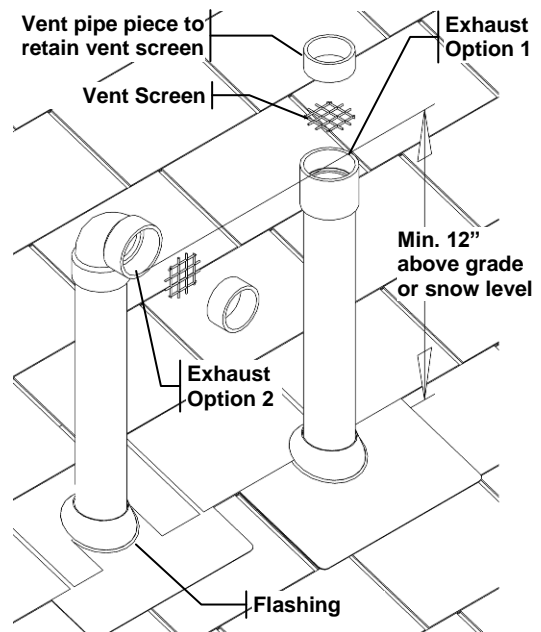


Figure 4-10(d)

Exhaust only Termination (Roof)



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 in. above the air inlet, and the air inlet must always be a minimum of 12 in. 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 - typical maximum snowfall is 19 in., thus the inlet must be $(12''+19'') = 31$ in. 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 in. 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 in. away from the wall.
8. **Vent Sloping:** All indoor exhaust piping must be on a slope back to the boiler a minimum of ¼ in. per linear foot of vent. For applications where excessive condensation is possible ½ in. per linear foot 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 in..
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 4-11.
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 4-9 and 4-10.
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. vertically) the location of the air-inlet pipe, so it is visible from at least 8 ft away. See Figure 4-9.
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 in., Max. = 60 in..
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 4-8 and 4-10 for roof top venting options.

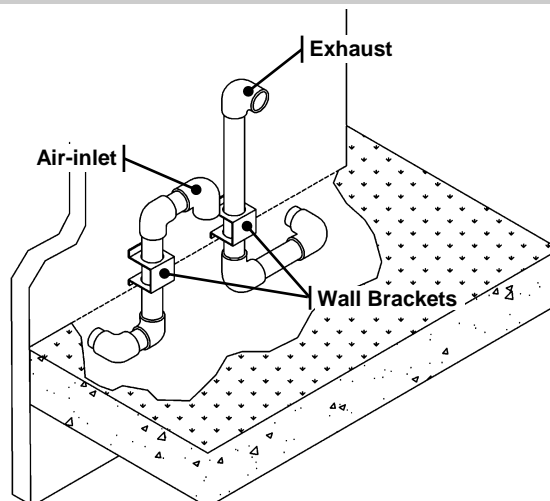


The vent for this boiler shall not terminate over public walkways; or near soffit vents or crawl space vents or other area where condensate or vapor could create a nuisance or hazard or cause property damage; or where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Figure 4-11 Venting Below Grade

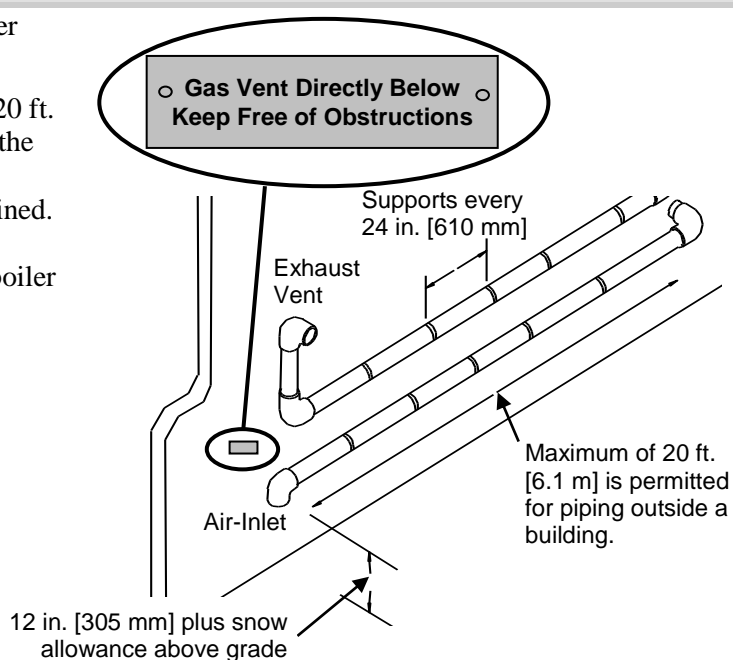
For installations that exit the wall below grade:

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 P/N. 82075 for securing the exhaust pipes (only applicable for 3 in. PVC/CPVC venting).
5. Ensure that the Vent/Air-inlet clearances are maintained, see Section 5.0 for details.

**Figure 4-12 Outdoor Venting**

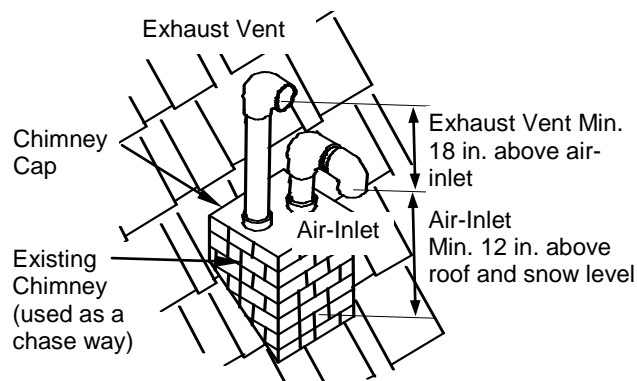
Vent piping outside the building is permitted under the following conditions:

1. The maximum length outside the building is 20 ft. 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 in..
4. The exhaust and inlet are sloped back to the boiler $\frac{1}{2}$ in. elevation for every linear foot.

**Figure 4-13 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 do not enter the vacant chimney.
3. Only Trinity Lx certified venting materials are used, see Table 4-4.
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.



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

5.0 VENT AND AIR-INTAKE TERMINATION CLEARANCES

**WARNING**

The quick reference table below is to be read in conjunction with the numbered notes as indicated, Figures 5-1 through 5-6, and the Venting Rules and Guidelines in Section 4.0. The instructions detailed in this section are a combination of Trinity Lx 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

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 Clearances Quick Reference Diagram

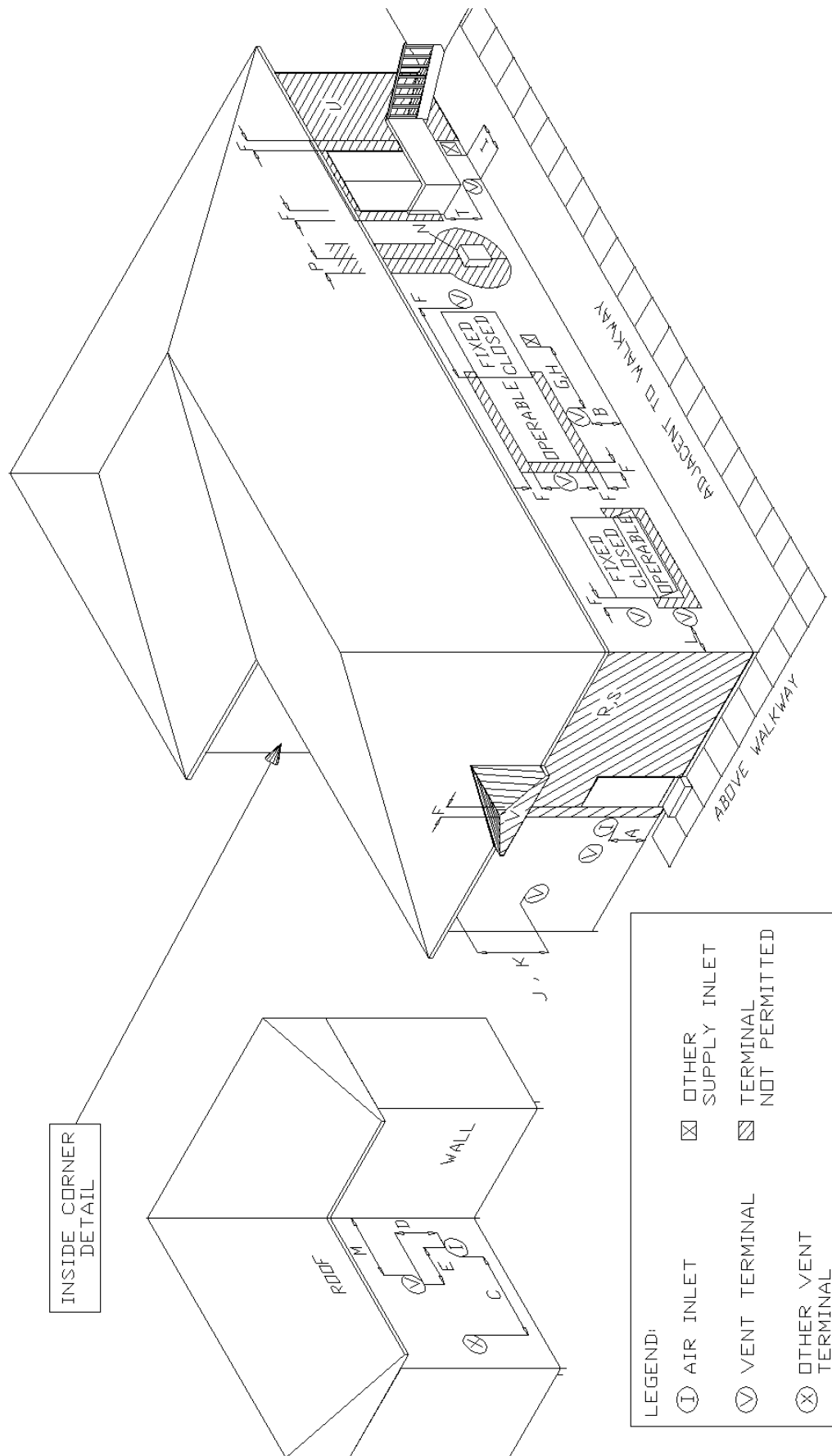
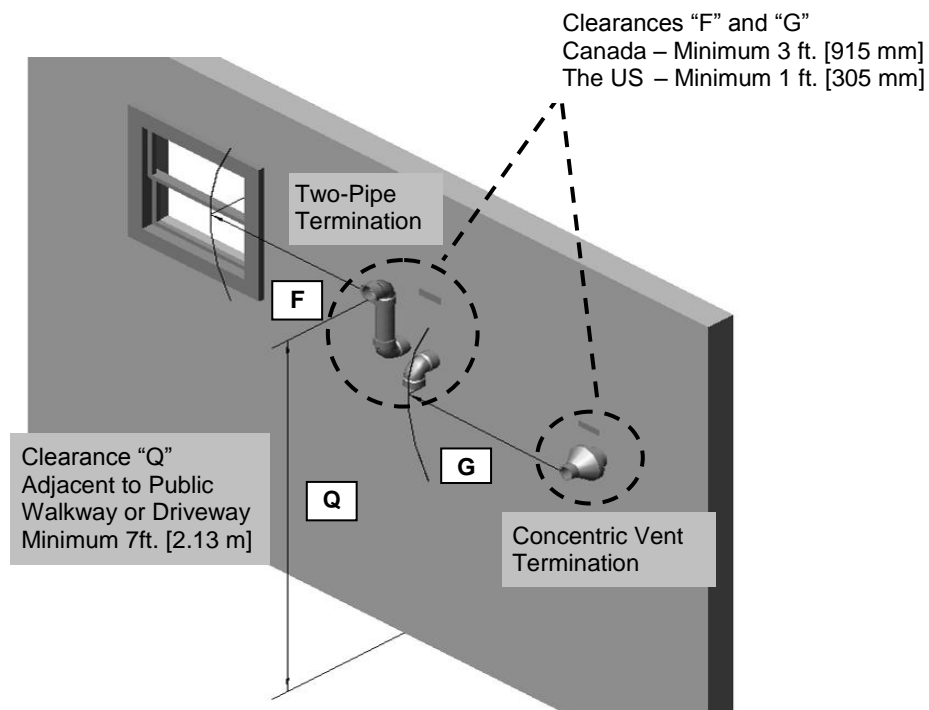


Figure 5-2 Sidewall Termination Clearances (See Table 5-1)



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 that 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 Figure 6-1 for further details):

- **DO NOT** install condensate lines 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 disposal system as condensate is very corrosive and will corrode most metallic drains and sewer pipes.
- When a condensate pump is used or required, select a pump that is designed for residential furnaces.

WARNING

If the combustion chamber has been flooded due to the condensate drain backing up, or for any other reason, the combustion chamber door must be removed and the inside of the boiler must be inspected for component damage, e.g. the internal insulation at the front and back of the chamber. Failure to follow these instructions may result in fire, property damage, serious injury or death.

Figure 6-1 All Models
Condensate Drain Piping

Drain Vent

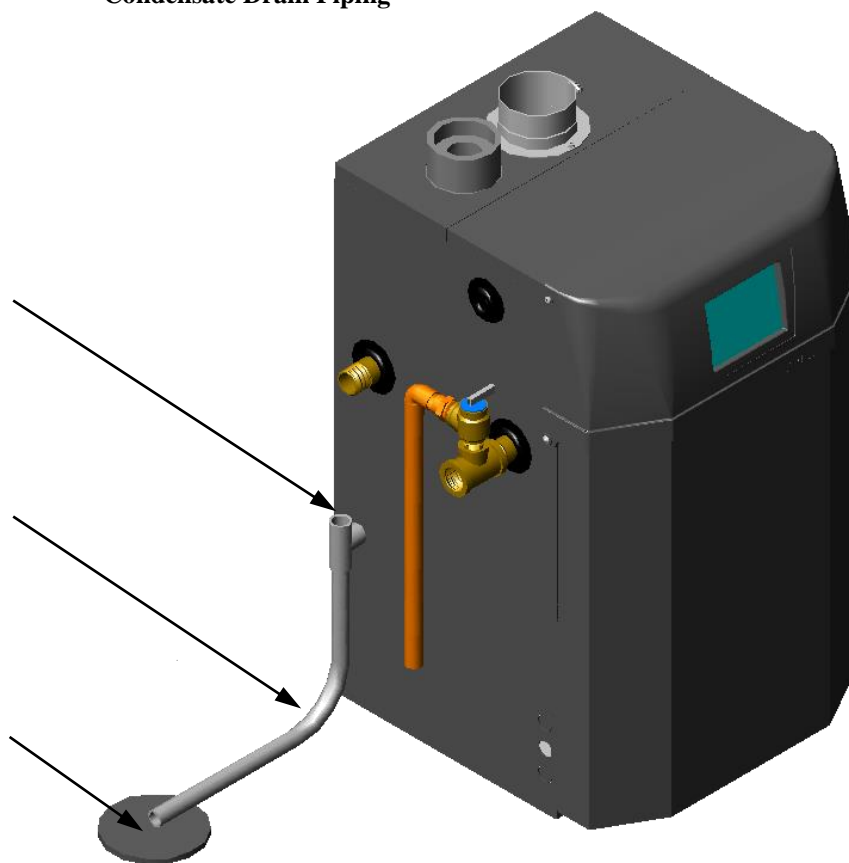
Do not block or install piping into the top branch of the condensate drain tee.

Drain Pipe

Connection to the bottom of the condensate drain tee must be made using 1/2" Schedule 40 PVC pipe. Secure using appropriate PVC cement. All piping must be below the level where the condensate leaves the boiler.

Floor Drain

Check with your local authorities regarding disposal of condensate (regulation may require the use of a neutralizer).



7.0 INSTALLING GAS PIPING



WARNING

The Trinity Lx 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 appliances 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 Gas to LP Propane Conversion Kit

Model Number	LP Conversion Kit Number	LP Orifice
Lx150-200	82650-1	52 (5.2 mm)
Lx300	82650-1	62 (6.2 mm)
Lx400	83017-1	62 (6.2 mm)
Lx500	84386-1	No Orifice ¹
Notes: ¹ No LP orifice is used with model Lx500, see conversion kit instructions for information on adjusting the throttle screw convert boiler to LP. ² Models Lx600-800 cannot be operated with LP – Propane. Use Natural Gas only.		

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 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 that the piping does not interfere with the vent pipe, or the removal of the valve, burner, and serviceable components.
- The boiler 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 gas valve or combustion blower can occur.
- Install a manual “Equipment Shut-Off Valve” as shown in Figure 7-1. Valve must be listed by a nationally recognized testing lab.
- 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

Flexible gas piping cannot be used within the boiler cabinet and cannot pass through the cabinet wall, use rigid piping as shown in Figure 7-1. Failure to follow these instructions may result in fire, property damage, serious injury or death.

⚠ WARNING

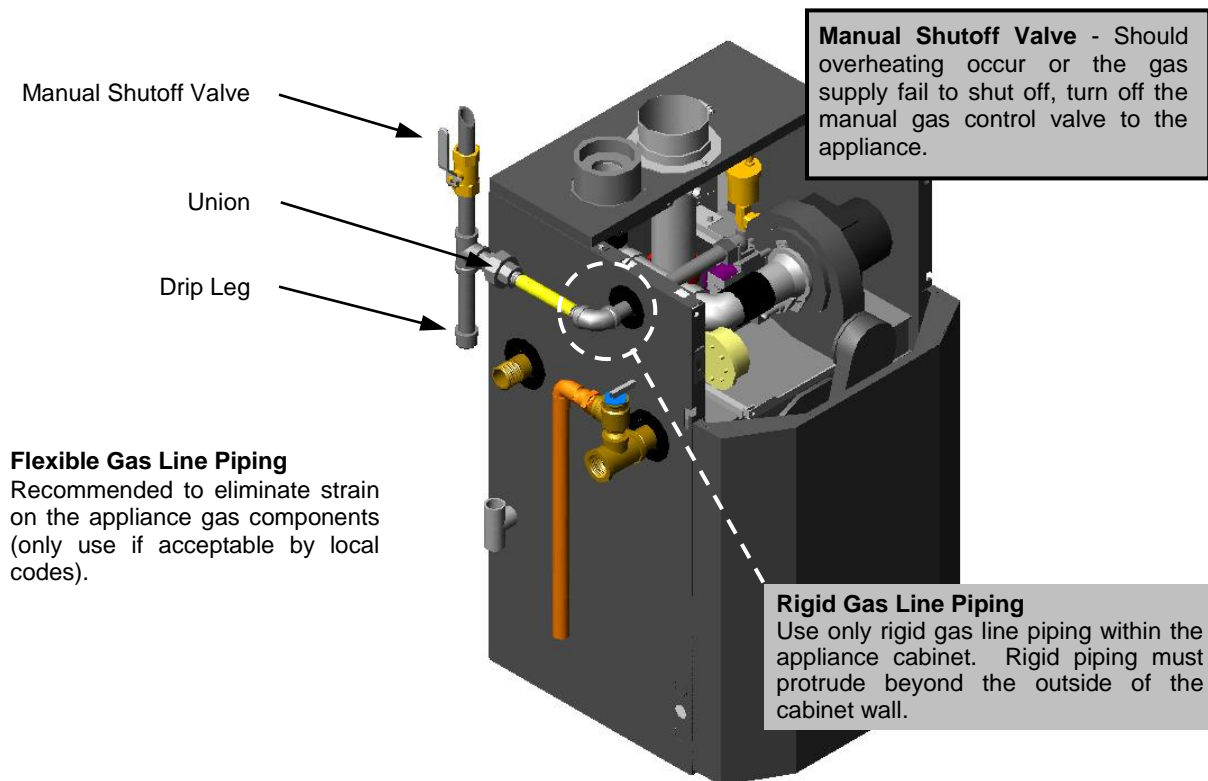
Do not use an open flame to test for gas leaks. Failure to follow these instructions may result in fire, property damage, serious injury or death .

⚠ WARNING

When performing a pressure test on the gas line piping, be sure the boiler 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 7-1 Gas Line Connection (Typical)

Model Lx200 Illustrated



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-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 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 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 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 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.

⚠ 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 Lx 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 5.5-10.5 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 or Carbon Dioxide analyzer, take a sample of the flue gas. The sample must fall within the acceptable ranges for Carbon Dioxide, which is 8.8% - 9.8% for Natural gas, and 9.8%-10.8% 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. 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.

⚠ 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.

⚠ WARNING

The flame probe uses a single electrode located in the burner door at the 6 O'clock position. DO NOT remove the wire from the dual electrode located in the burner door at the 3 O'clock position; this device is used for spark igniting and delivers a high voltage potential which would result in an EXTREME ELECTRICAL SHOCK possibly causing 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 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 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 professional 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 shut-off valve to the off position.

9.0 GAS VALVE AND BURNER SET-UP

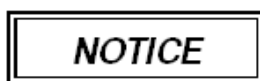


The Trinity Lx gas valve must be set-up by a licensed Gas Technician. Improper set-up may result in incorrect operation, damage to components or property, injury or death.

Gas Line Pressure

The boiler gas valve is equipped with a line pressure test port; see Figures 9-1 through 9-4. 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 (Lx150-500 models). This port is directly connected to the gas line feeding the boiler. For Lx600-800 models, replace 1/8" NPT plug in the inlet flange of the gas valve with a hose barb fitting suitable for manometer tubing used. See Figures 9-1 through 9-5.
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 applications 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, incase 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. For the Lx600-800 models, replace the installed hose barb fitting with the factory 1/8" NPT plug; use NG/LP approved thread sealant.



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



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

Table 9-1 Line Pressure and Combustion Parameters

Gas	Line Pressure (inches wc)			CO ₂ (%) ¹		CO (ppm) Max.
	Nominal/Desired	Min.	Max.	Min.	Max.	
Natural	7	4 ²	10.5	8.8	9.8	175
Propane	11	8	13	9.8	10.8	175

Notes:
¹ It is permissible to have higher CO₂ values with the burner operating at the minimum modulation rate.
² The minimum permissible line pressure when operating with Natural Gas is 5.5 inches wc for model Lx500.

Table 9-2 Minimum and Maximum Modulation Rates

Modulation Rates (rpm)	Lx150	Lx150E	Lx200	Lx300	Lx400	Lx500	Lx600	Lx700	Lx800
Minimum	1150	925	925	1250	1550	1400	1050	1250	1250
Maximum	5850	4450	5950	5850	7250	6400	4350	4300	5300



Carbon Monoxide - Never leave the boiler operating if emitting Carbon Monoxide (CO) concentrations in excess of 175ppm. Failure to comply may result in injury or death.



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.

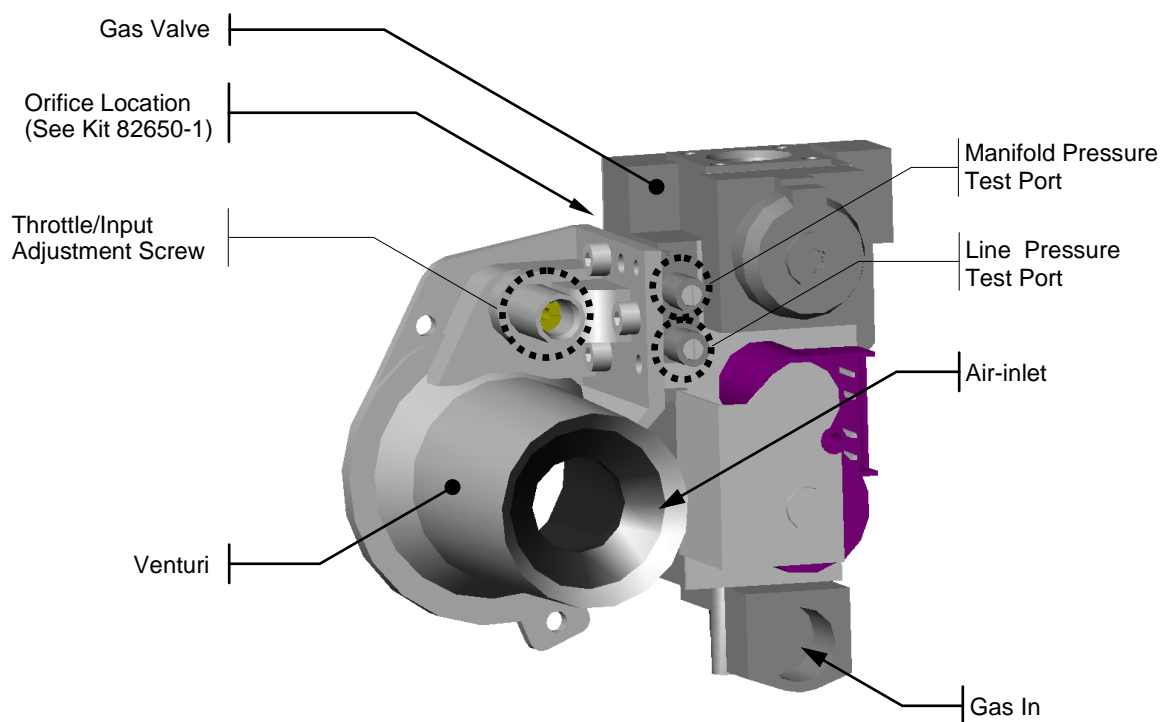
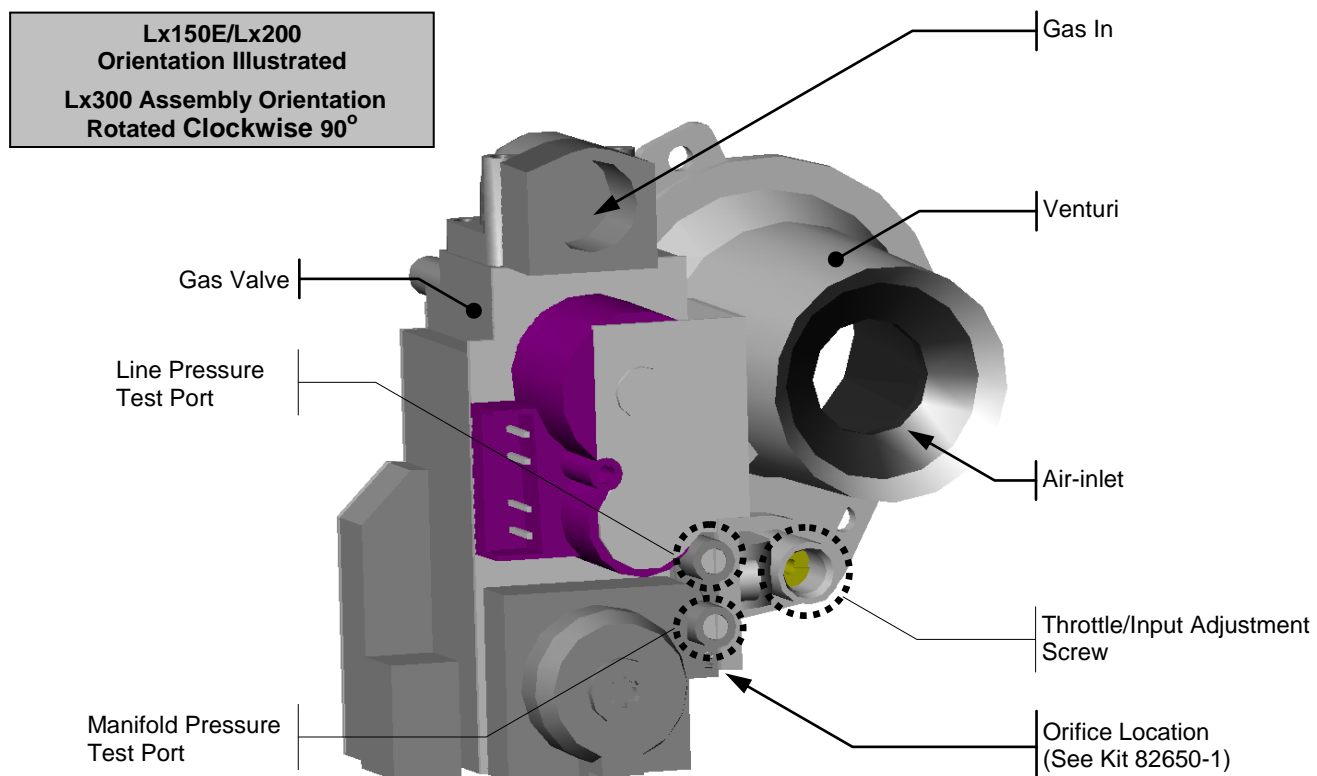
Figure 9-1 Gas Valve and Venturi Assembly (Lx150-300)**Lx150 Orientation Illustrated****Figure 9-2 Gas Valve and Venturi Assembly (Lx150-300)****Lx150E/Lx200 Orientation Illustrated**

Figure 9-3 Gas Valve and Venturi Assembly (Lx400)

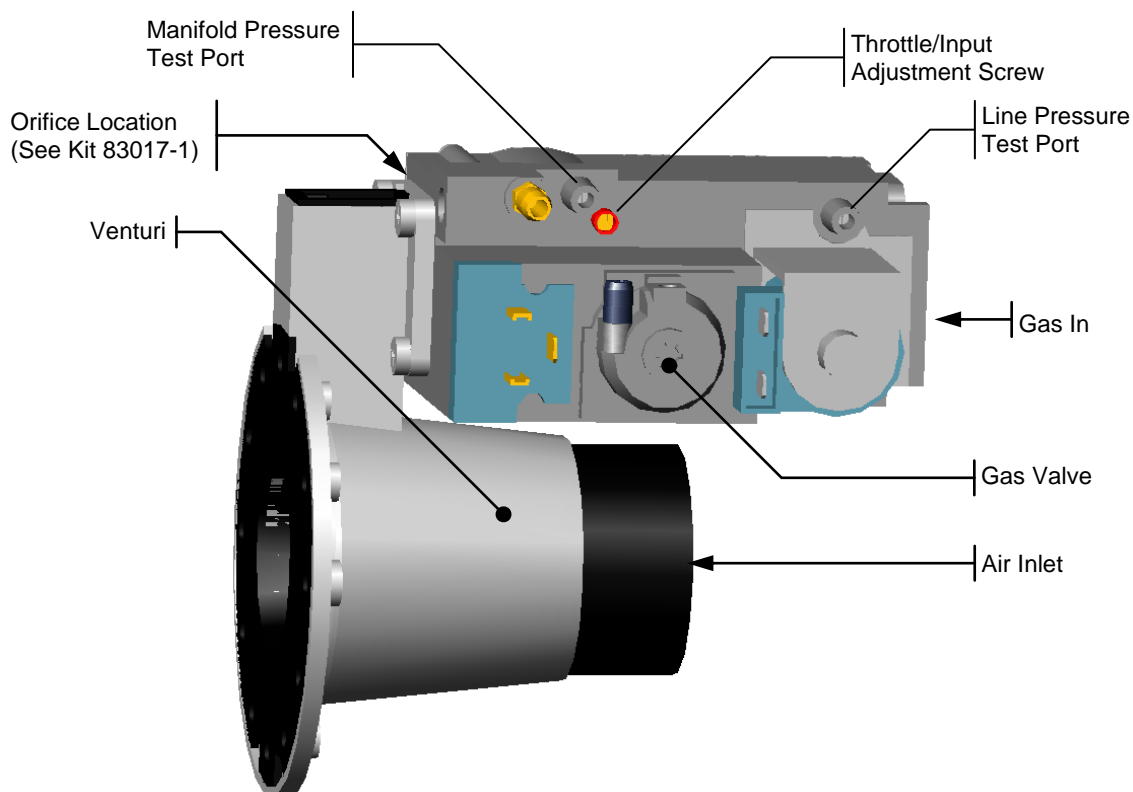


Figure 9-4 Gas Valve and Venturi Assembly (Lx500)

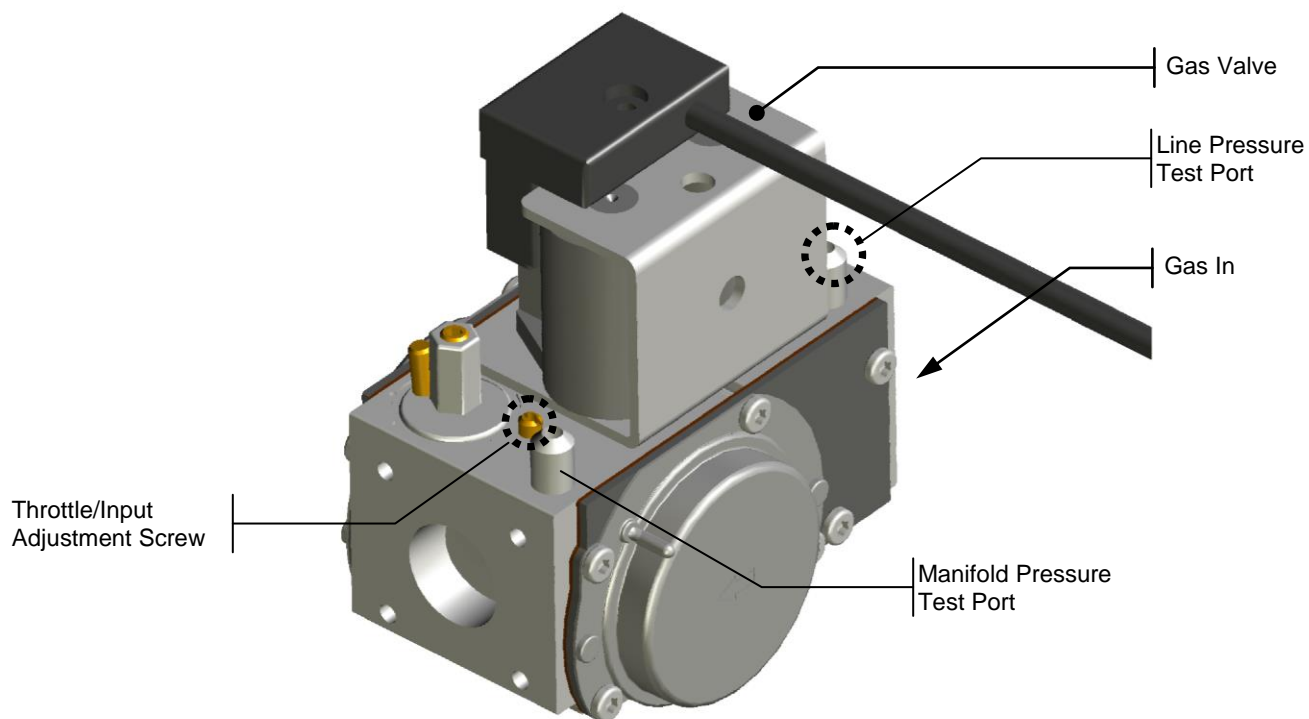
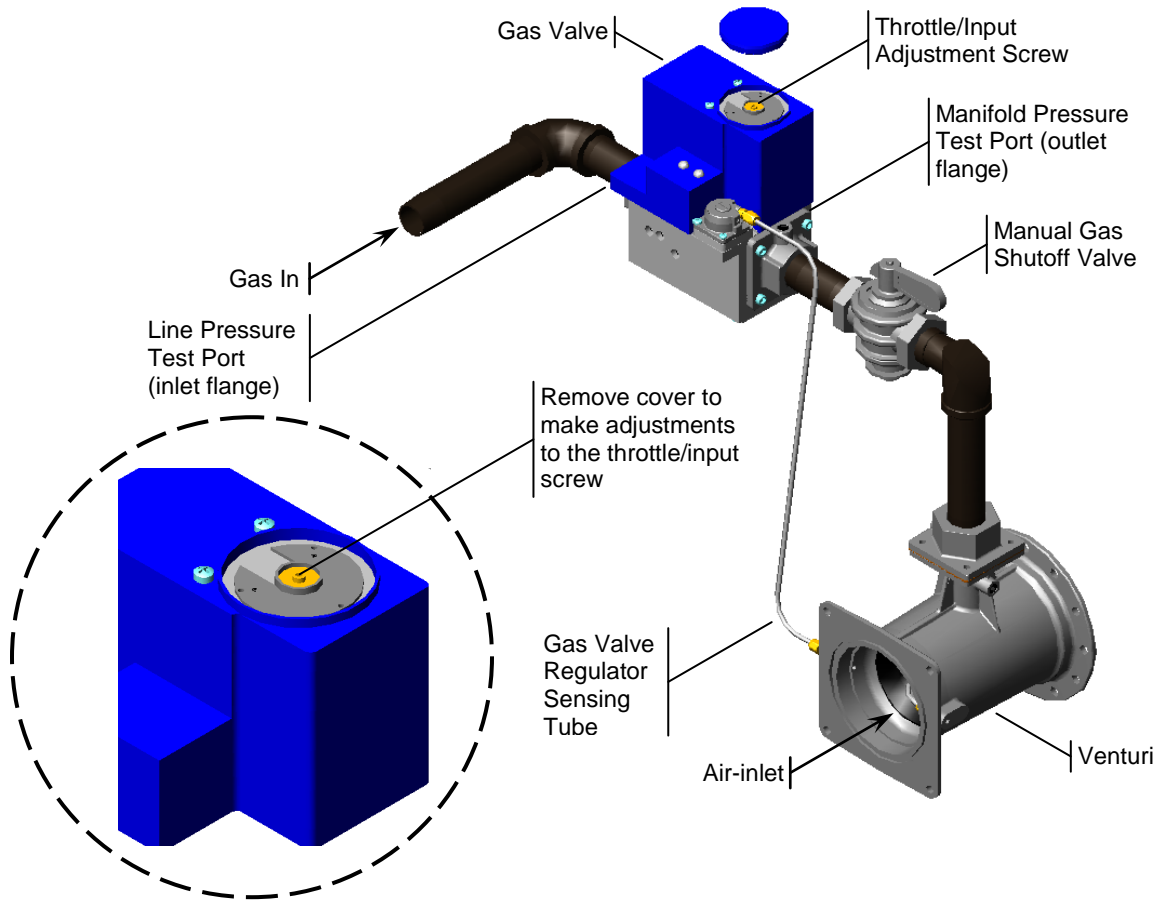


Figure 9-5 Gas Valve and Venturi Assembly (Lx600-800)



Adjustment

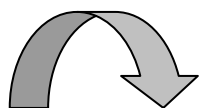
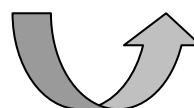
Input Screw Adjustments - The boiler is equipped with a Throttle/Input Adjustment Screw, located on the Gas Valve and Venturi Assembly. The Throttle screw is used to adjust the flow of gas leaving the gas valve, entering the Venturi and hence entering the combustion air stream. By turning the adjustment 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. See Figure 9-6 for screw direction.

Lx150-300 Adjustments - The throttle screw for models Lx150-300 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 Figures 9-1 and 9-2 for throttle screw location.

Lx400 Adjustments - The throttle screw for the Lx400 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 9-3 for throttle screw location.

Lx500 Adjustments - The throttle screw for the Lx500 is a multiple turn valve. Typical adjustment required for Natural Gas is 0-1 full turns in or out from the factory setting. To adjust combustion for Propane Gas, turn the throttle screw all the way in (clockwise until it stops), then turn the throttle screw out (counterclockwise) 4-1/2 turns and set with a combustion analyzer. See Figure 9-4 for throttle screw location.

Lx600-800 Adjustments - Remove the cap and adjust the input screw by turning it clockwise to decrease gas flow and counter-clockwise to increase gas flow. Typical adjustment required is 0-1/8 turns in or out. See Figure 9-5 for throttle screw location.

Figure 9-6 Throttle/Input Adjustment Screw (All Models)**Decrease Gas - Turn Clockwise****Increase Gas - Turn Counter Clockwise**

IF FOR ANY REASON THE INPUT SCREW IS ADJUSTED, A "COMBUSTION ANALYZER" MUST BE USED TO ENSURE SAFE AND PROPER OPERATION OF THE GAS VALVE.

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 9-1. 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 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 CO₂ 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 CO₂ 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 Lx 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.

DANGER

Models Lx150-400 require the installation of an LP orifice prior to operating with Propane Gas, see Propane conversion instructions for more details. To convert the Lx500 to operate with Propane Gas requires field calibration of the throttle/input screw; see "Lx500 Adjustments" in Section 9.0 and Propane conversion instructions. Models Lx600-800 only operate with Natural Gas; conversion to Propane is not an option. Failure to follow these instructions will result in property damage, personal injury or death.

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 - Trinity Lx flue gas test ports are located in the flue outlet adapter assembly. Test port access is either from inside the boiler cabinet (Lx150, Lx150E & Lx200; Figure 9-7) or from outside the boiler cabinet (Lx300-800; Figures 9-8 through 9-10). Remove the test port plug, perform flue gas analysis, and adjust throttle/input screw as required until CO₂ and CO levels are within acceptable limits, see Table 9-1 Line Pressure and Combustion Parameters. Once flue gas sampling completed, re-install test port plug. For model with a threaded plug, seal threads with Teflon tape before reinstalling plug.

DANGER

Failure to re-install the test port plug will result in damage to the unit, property damage, fire, explosion, serious injury or death.

Figure 9-7 Flue Gas Sampling Using Test Port (Lx150-200)

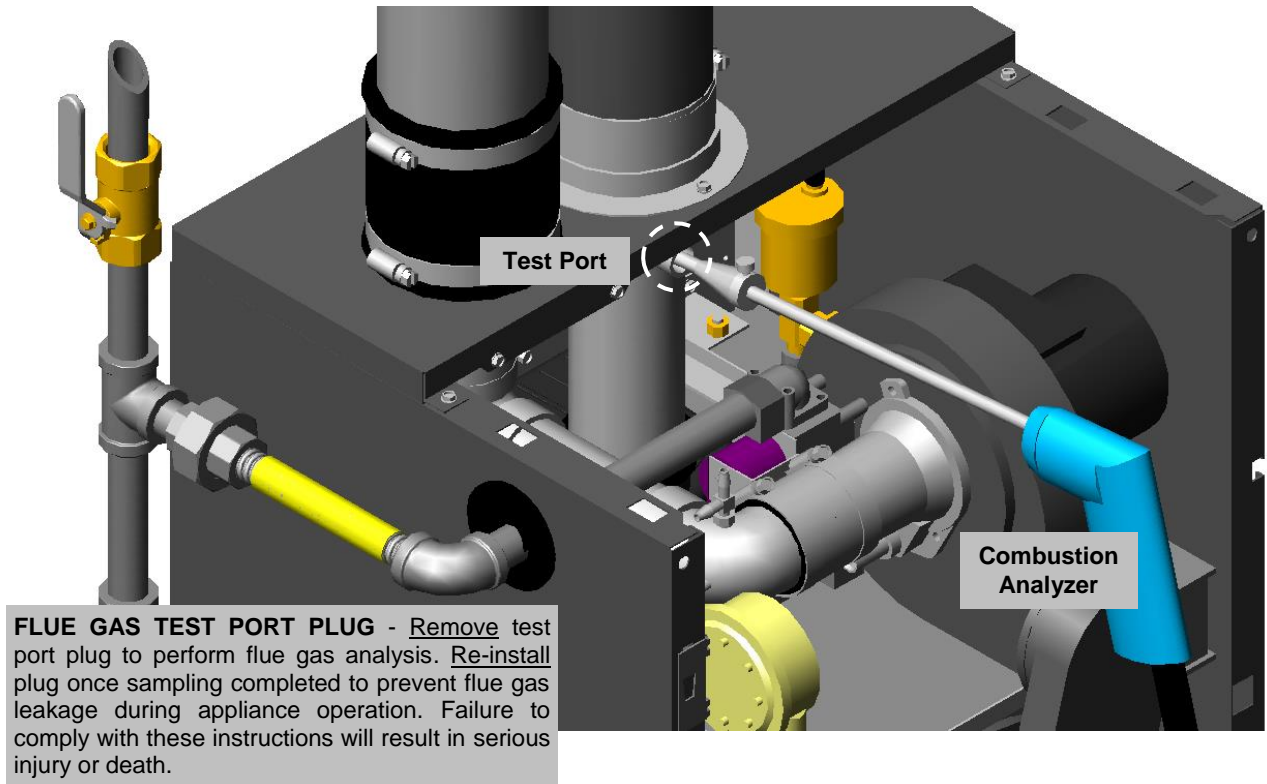


Figure 9-8 Flue Gas Sampling Using Test Port (Lx300-400)

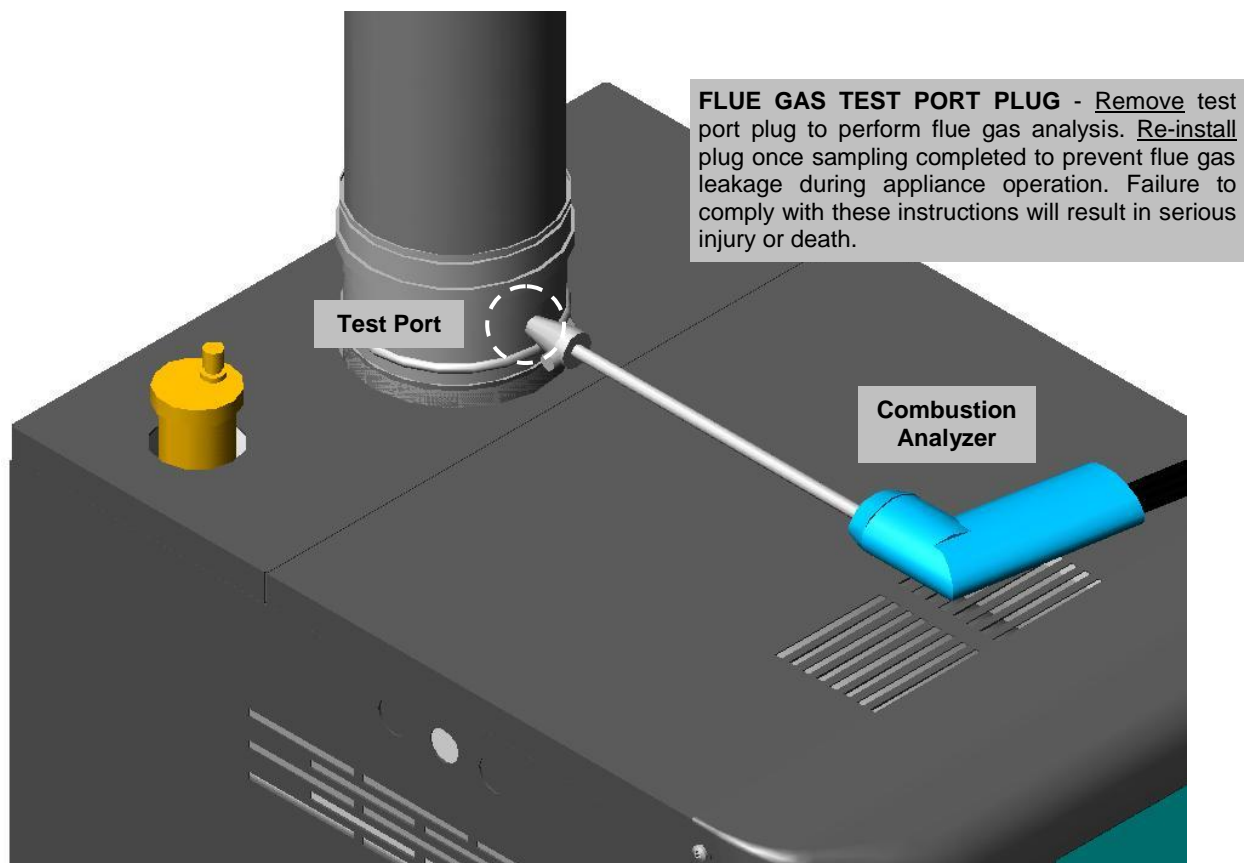


Figure 9-9 Flue Gas Sampling Using Test Port (Lx500-600)

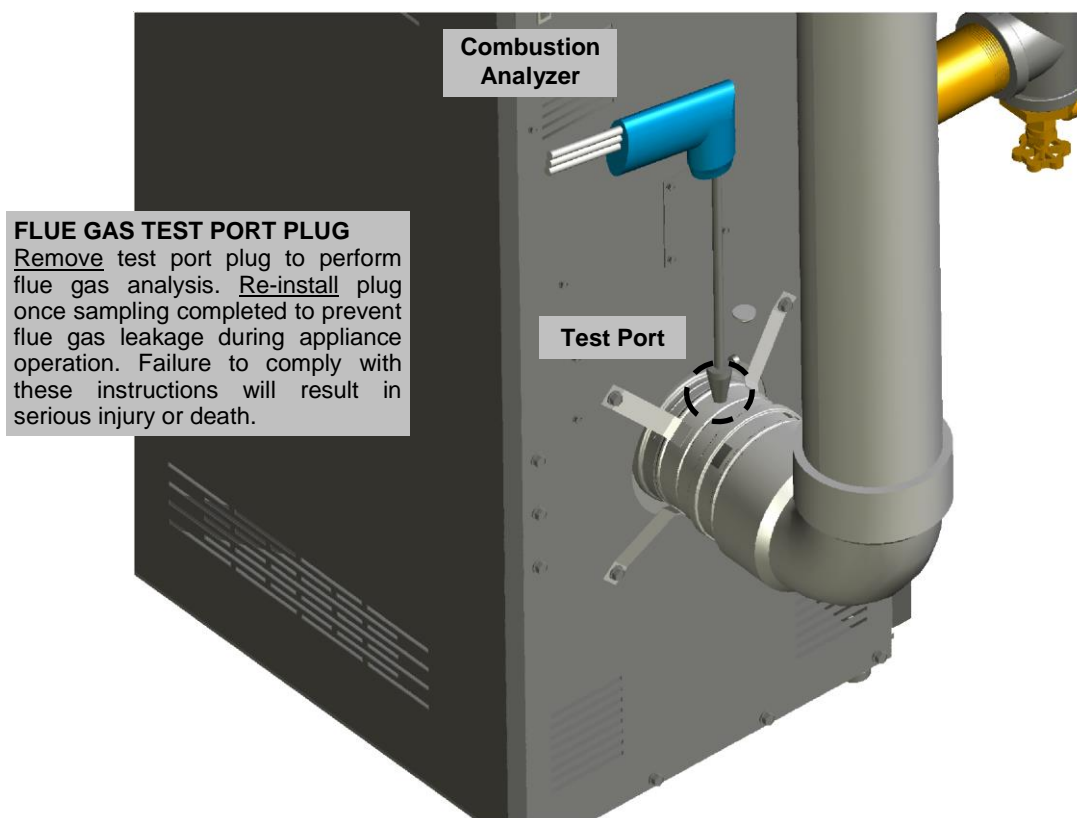
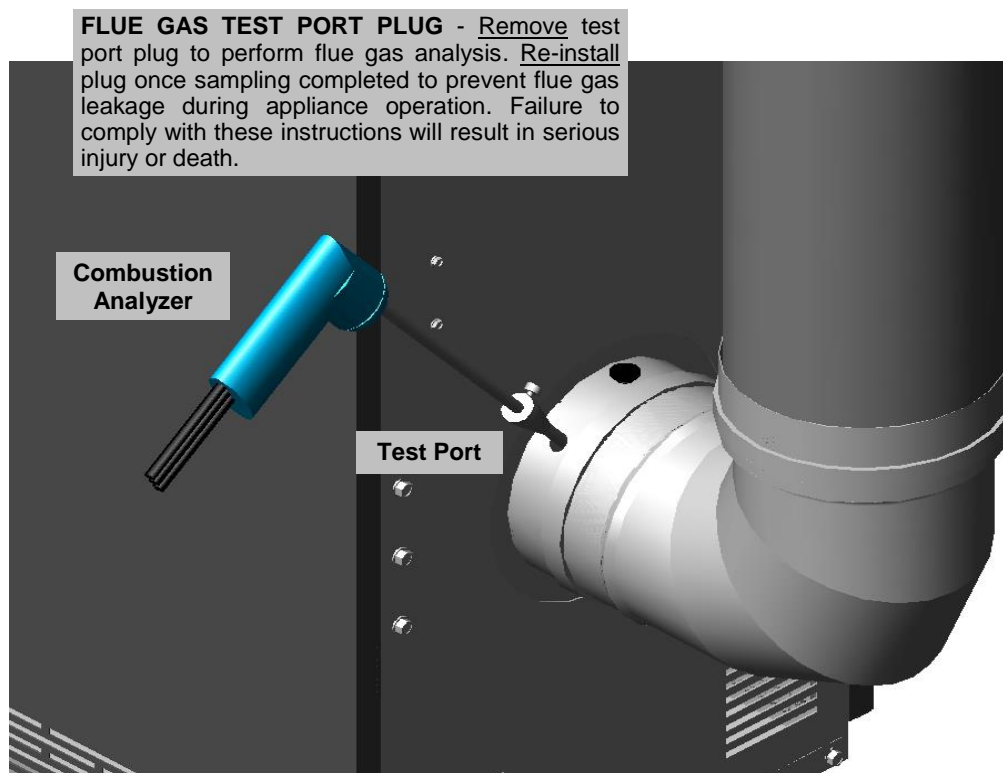


Figure 9-10 Flue Gas Sampling Using Test Port (Lx700-800)



10.0 BOILER AND HEATING SYSTEM 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 cleansed of all build-up including sludge and scale. All systems, old and new, must be cleansed to remove flux, grease and carbon residue. NTI recommends cleansing 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 cleansing, follow the instructions included with the Ferrox DS-40 System Cleaner. See Table 10-1 for a list of recommended boiler cleansing 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.

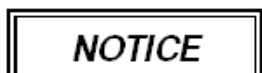
Table 10-1 Boiler System Cleansers and Corrosion Inhibitors

Application	Ferrox 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 - The 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 (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.



The Trinity Lx 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 Lx 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 7.5 and 9.5.
- Chloride – less than 125mg/l.
- Conductivity – 100 to 300µS/cm (at 25°C); [TDS 50 to 150ppm or Total Hardness 3 to 9grains/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. Each Trinity Lx boiler is provided with at least 1 bottle of “Ferrox F1” corrosion inhibitor (Lx500-800 come with 2 bottles), 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 10-1 for a list of recommended boiler system cleansers 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 “de-rated” 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 and must be field installed at the boiler outlet in the vertical position, as shown in Figures 10-1(a) and (b), with the drain pipe outlet exiting the side of the pressure relief valve horizontally and elbowing down. Lx150-400 models come with a 30 psi relief valve, while Lx500-800 models come with a 50 psi relief valve. The maximum allowable working pressure (MAWP) varies with boiler model, see Table 10-2; alternate relief valves may be used, so long as they are ASME certified and meet the requirements for the respective boiler.

CAUTION

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.

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 Lx units come with a factory supplied Pressure Gauge. The pressure gauge must be installed at the boiler outlet, prior to any circulators, and in the vicinity of the pressure relief valve. See Figures 10-1(a) and (b).

Table 10-2 Pressure Relief Valve Specifications

Boiler Model	Maximum Pressure Relief Valve Setting / Boiler MAWP (psi)	Minimum Pressure Relief Valve Capacity (MBH)
Lx150	30	150
Lx150E	145	150
Lx200	145	200
Lx300	160	300
Lx400	145	400
Lx500	160	500
Lx600	160	600
Lx700	160	700
Lx800	160	800
Notes: ¹ Lx150 models sold in US have a MAWP = 145 psi.		

Figure 10-1(a) Near Boiler Piping (Lx150-400)

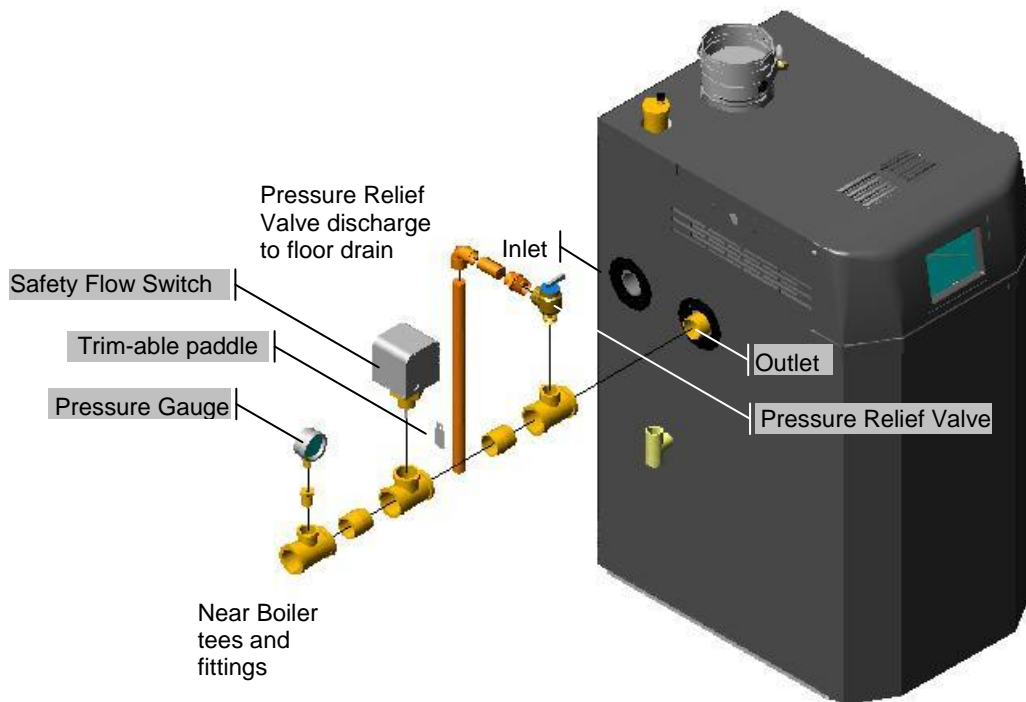
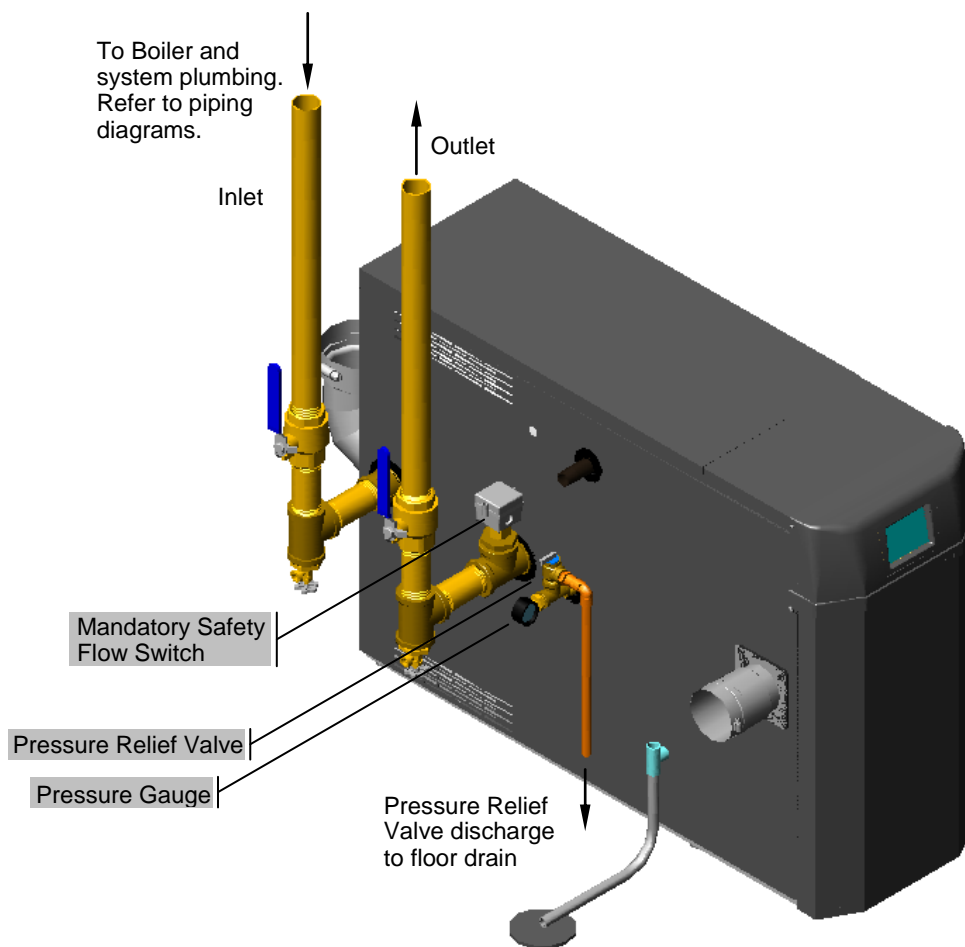


Figure 10-1(b) Near Boiler Piping (Lx500-800)



Low Water Cutoff (LWCO) / Safety Flow Switch – Trinity Lx150-400 boilers are provided with a factory installed Water Pressure Switch; in the event the pressure drops below 10 psi, the burner is inhibited from firing. Where required by the Authority having jurisdiction, an external LWCO, or Safety Flow Switch, may have to be installed; see Figures 10-1(a) and (b) for Safety Flow Switch installation.

NOTICE

When using a Safety Flow Switch, it must be installed on the boiler outlet fitting (see Figure 10-1) in accordance with the instructions provided with the flow switch. Install the flow switch in a 1" diameter line for models Lx150-200, and a 1-1/4" diameter line for models Lx300-400.

NOTICE

Models Lx500-800 come equipped with a factory installed flow switch installed in a 2" diameter line. The flow switch is pre-plumbed with a Nema 4 rated enclosure and prewired via liquid-tight conduit. According to ASME CSD-1, a flow switch must be used in lieu of a Low Water Cut Off (LWCO) for a water tube boiler.

NOTICE

When external safety devices are used, such as a LWCO, Flow Switch, or a Temperature Limiting Switch, they must be wired as per the instructions provided in this manual. Refer to Section 12.0 for wiring instructions.

Boiler System Plumbing

The Trinity Lx boiler uses a low mass heat exchanger that requires a minimum rate of forced water circulation any time the burner is operating (See Table 10-4 for minimum flow rates). To ensure the minimum flow rate is attained, the boiler must 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 Figures 10-2 and 10-3 for examples). As well as a Primary/Secondary Loop Configuration utilizing closely spaced tees, a properly installed system will as a minimum include the major components in Table 10-3.

Table 10-3 System Major Component Checklist

Factory Supplied Components	Field Supplied Components
<input type="checkbox"/> Pressure Relief Valve ¹	<input type="checkbox"/> Boiler Loop Circulator (Pump B in Figure 10-2 or Pump C in Figure 10-3)
<input type="checkbox"/> Pressure Gauge	<input type="checkbox"/> DHW Loop Circulator (Pump A in Figure 10-2 and Figure 10-3, for applications utilizing Indirect Fired Water Heater only)
<input type="checkbox"/> Flow Switch (Lx500-800 only)	<input type="checkbox"/> Central Heat (CH) Loop Circulator(s) (CH Circulator - Pump C in Figure 10-2; Zone Circulators in Figure 10-3)
	<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
Notes: ¹ Refer to Table 10-2 for a list minimum Pressure Relief Valve specifications.	

Circulating Pumps – Trinity Lx150-400 boilers are equipped with three 120VAC pump outputs, while the Lx500-800 is equipped with 3 pump contacts (relays):

1. PUMP A "DHW Pump" - operates during a Domestic Hot Water demand
2. PUMP B "Boiler Pump" - operates during any demand
3. PUMP C "CH Pump" - operates during a Central Heat demand (CH1 or CH2)

Ensure pumps are oriented as per the manufacturers' instructions. Wiring of these circulators will depend on the system configuration chosen; see Figures 10-2 and 10-3. For further wiring details see Section 12.0.

NOTICE

Circulators responsible for forcing the water flow rate through the boiler must be sized according to Table 10-4, see Figures 10-2 and 10-3 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 10-4 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	Armstrong
150	8' at 7 GPM	1"	6	45°F	NRF-36	UPS 15-58 ¹	0011	Astro 50
150E	4' at 7 GPM	1"	6	45°F	NRF-22 ¹	UPS 15-58 ¹	0011	Astro 30
200	7' at 10 GPM	1-1/4"	8	45°F	NRF-36	UPS 26-99	0011	Astro 50
300	7' at 14 GPM	1-1/4"	11	45°F	NRF-36	UPS 26-99	0011 ¹	E7
400	10' at 20 GPM	1-1/2"	16	45°F	NRF-36	UPS 26-99	0011 ¹	E8
500	12' at 25 GPM	2"	20	45°F	PL-36 ¹	UP 43-100	2400-20 ^{1,3}	E8 ¹
600	10' at 30 GPM	2"	24	45°F	PL-55 ⁵	UPS 26-150	2400-45 ⁴	E15 ¹
700	9' at 35 GPM	2"	28	45°F	PL-55 ⁵	UPS 26-150 ¹	2400-45 ⁴	E15 ¹
800	11' at 40 GPM	2"	32	45°F	PL-55 ⁵	UP 43-110 ²	2400-45 ⁴	E15 ¹

Notes:¹ NOT recommended for DHW indirect circulator when installed as per Figure 10-3, recommend higher head circulator.² Grundfos UPS 32-160 can be used in place of UP 43-110; Grundfos UPS 26-150 can be used in place of UPS 43-100.³ Taco 2400-40 NOT recommended.⁴ Taco 2400-60 NOT recommended.⁵ B&G PL-75 and PL-130 NOT recommended.

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.

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 boiler. 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 10-2 and 10-3.

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 10-2 and 10-3.

Indirect Fired Water Heater – When installed as per Figure 10-3, the indirect fired water heater is in series with the boiler during a demand for DHW. Therefore when using this configuration 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 10-5, when installed as per Figure 10-3.

Table 10-5 Maximum Indirect Fired Water Heater Head Loss (Boiler Side) at Minimum Flow

Lx150	10' at 6 GPM	Lx500	18' at 20 GPM
Lx150E	14' at 6 GPM	Lx600	18' at 24 GPM
Lx200	14' at 8 GPM	Lx700	15' at 28 GPM
Lx300	12' at 11 GPM	Lx800	12' at 32 GPM
Lx400	9' at 16 GPM		

Figure 10-2: 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

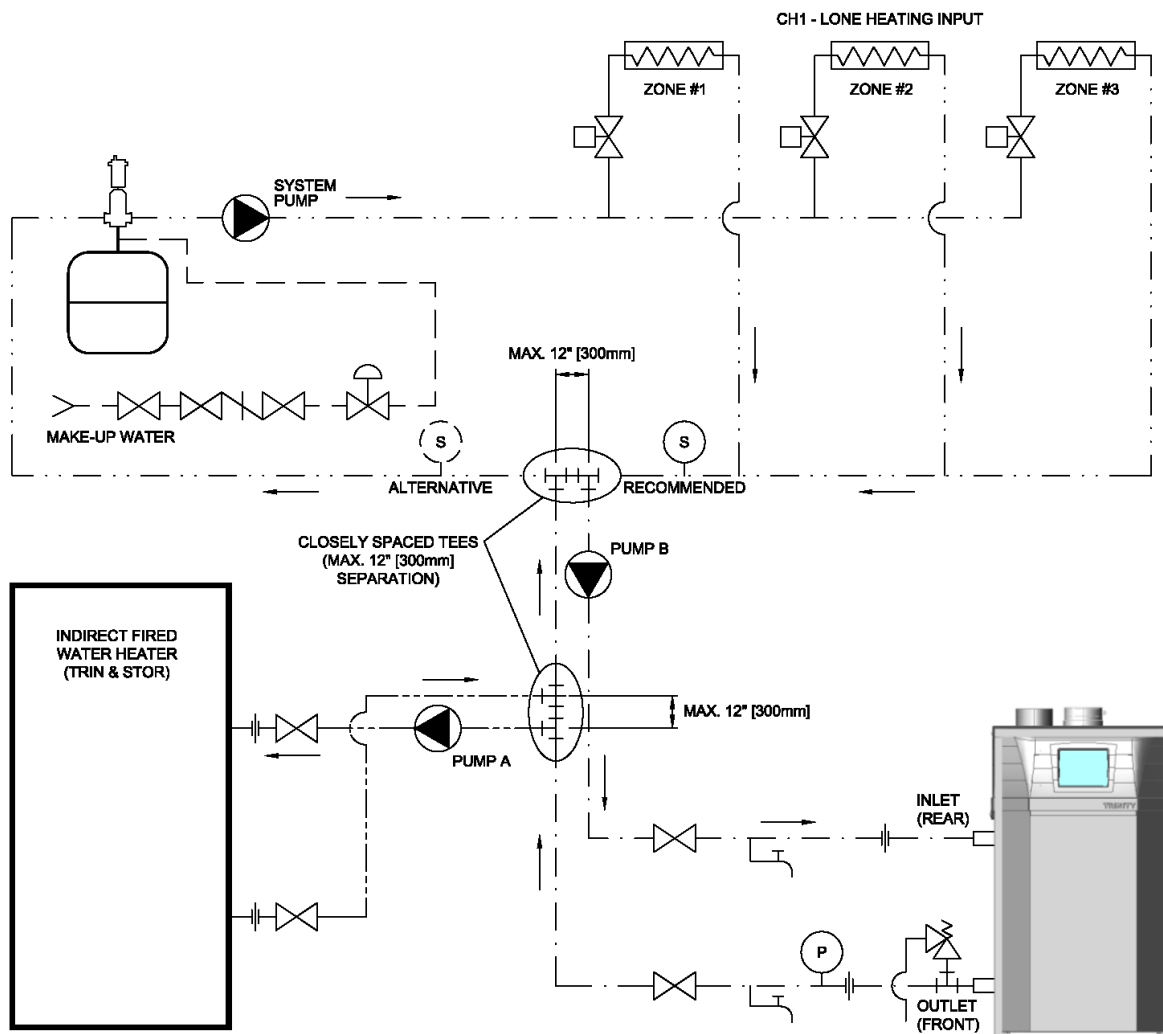
The piping configuration described above requires the Central Heating system and DHW system to be de-coupled from the “Primary Loop” via closely spaced tees (Figure 10-3).

Figure 10-3: 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 out (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 10-2 and 10-3 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.

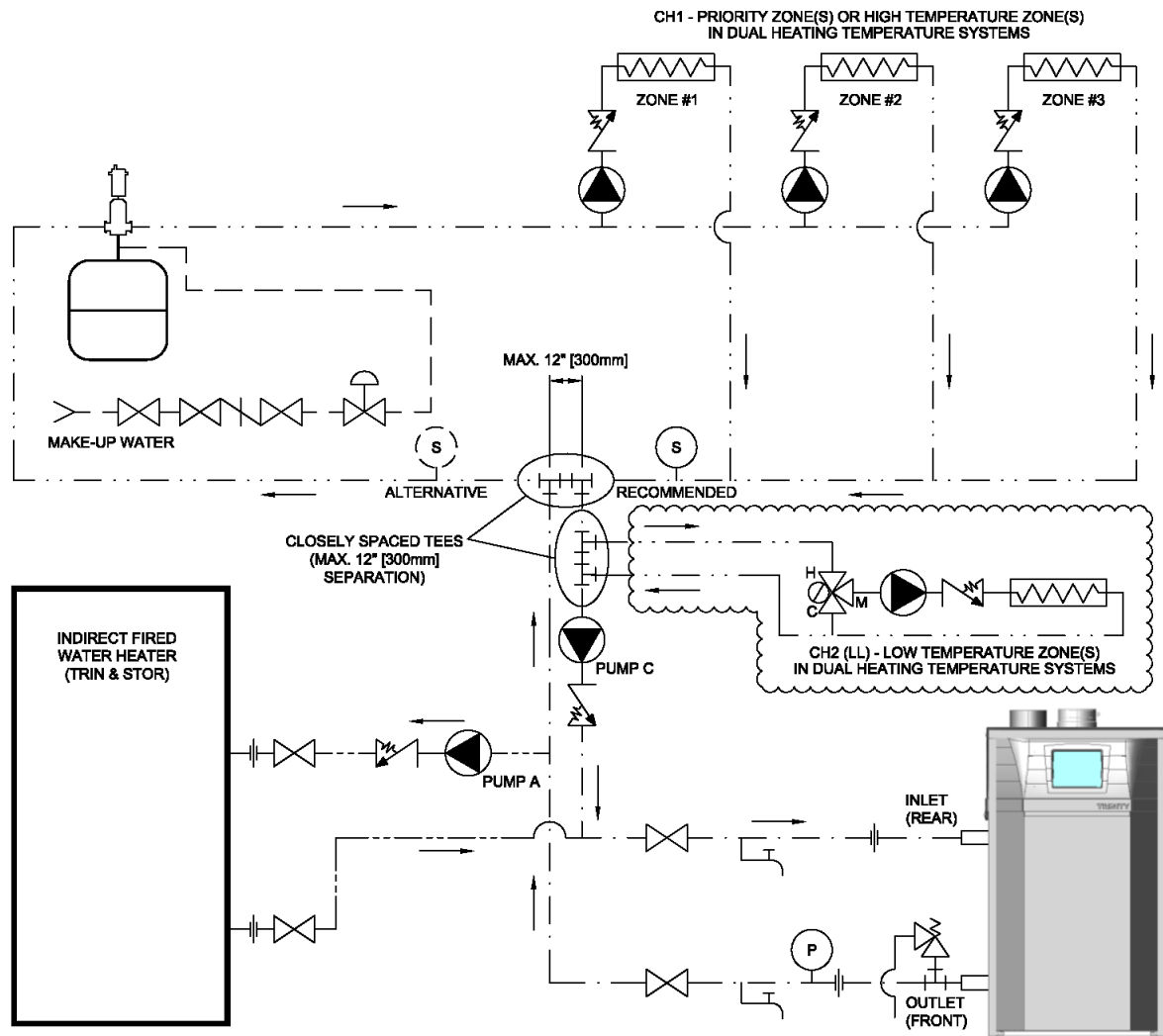
Figure 10-2 Primary / Secondary Plumbing
(Single System Circulator Configuration)



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		SYSTEM SENSOR
	ZONE LOAD		PRESSURE GAUGE		

**Figure 10-3 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		PRESSURE GAUGE		SYSTEM SENSOR
	THERMOSTATIC MIXING VALVE		OPTIONAL		

11.0 LEAD LAG INSTRUCTIONS

Multiple Boiler Applications

The Lx 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. 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.

Lead Lag Instructions - Common

Plumbing – install as many as 8 Lx 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* Figures and Tables 12-1(a) and 12-1(b). The Boiler Pump must be sized according to Table 10-4.

Communication Wiring – using 3-wire cable, daisy-chain terminals *LL DATA +*, *LL DATA –* and *SENSOR COM* of each boiler in parallel; see *Field Wiring* Tables 12-2(a) and 12-2(b) 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 (OD / SYS SENSOR* for Lx500-800 models) of the Master Boiler; see *Field Wiring* Tables 12-2(a) and 12-2(b) 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 [S5 (J8-11) sensor for Lx500-800 models]

Outdoor Sensor (Optional) – wire the outdoor sensor to *SENSOR COM* and *OD SENSOR (OD / SYS SENSOR* for Lx500-800 models) of any one of the boilers in the cascade (for Lx500-800 models, outdoor sensor must be connected to a non-Master boiler); see *Field Wiring* Tables 12-2(a) and 12-2(b) 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 **one** (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:

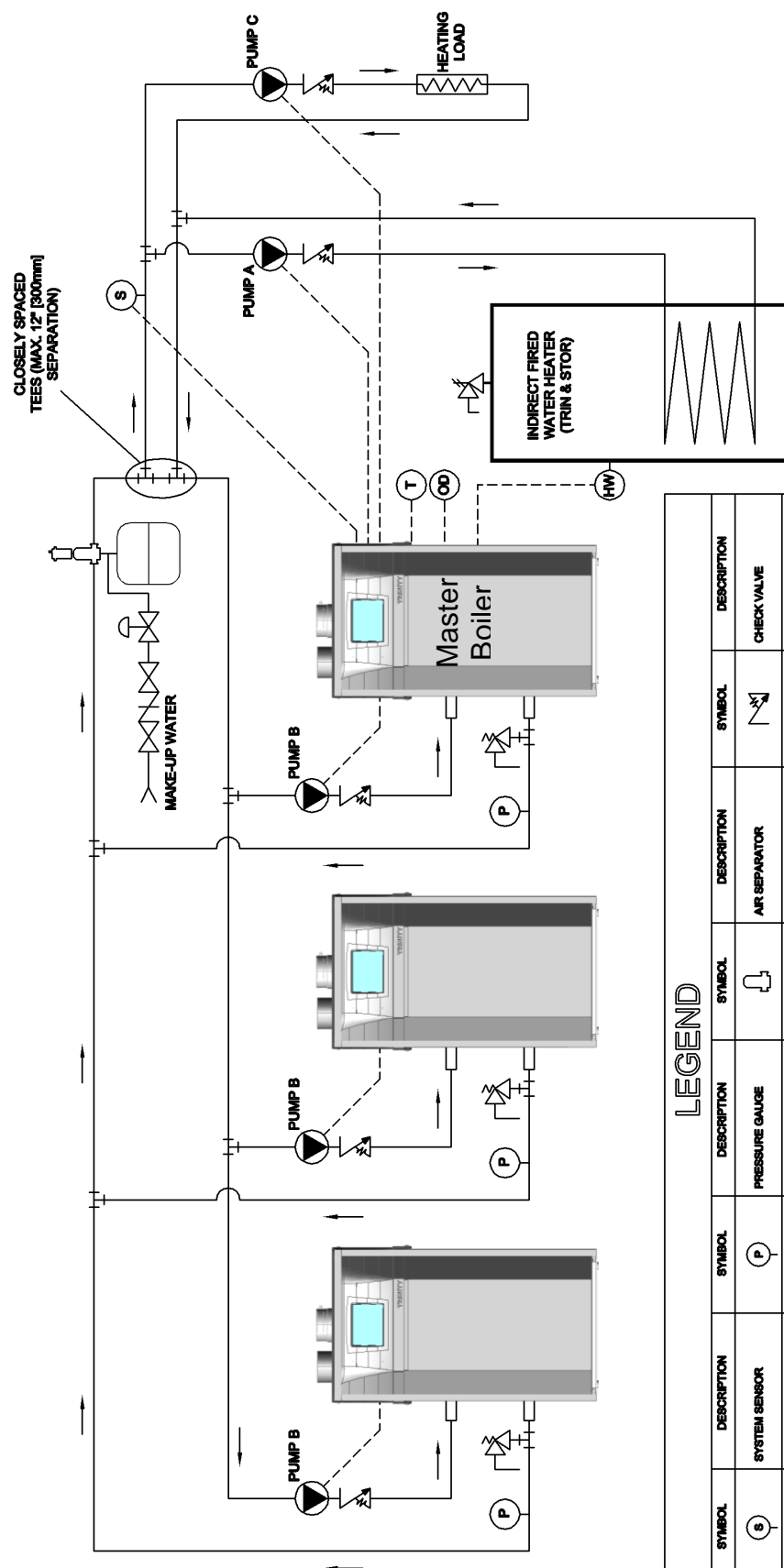
Configure – Lead Lag Master Configuration – Master enable

















Table 11-1 Minimum Pipe Sizes for Multiple Boiler Applications

# of Units	Lx150/150E	Lx200	Lx300	Lx400	Lx500	Lx600	Lx700	Lx800
2	1-1/2"	2"	2"	2-1/2"	2-1/2"	3"	3"	3"
3	2"	2"	2-1/2"	3"	3"	3"	4"	4"
4	2"	2-1/2"	2-1/2"	3"	4"	4"	4"	4"
5	2-1/2"	2-1/2"	3"	4"	4"	4"	4"	5"
6	2-1/2"	3"	3"	4"	4"	4"	5"	5"
7	2-1/2"	3"	4"	4"	4"	5"	5"	5"
8	2-1/2"	3"	4"	4"	5"	5"	5"	5"

Figure 11-1 All Models

Multiple Boiler Lead-Lag Plumbing Configuration



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

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* Tables 12-2(a) and 12-2(b) 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* Figures and Tables 12-1(a) and 12-1(b). 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

Sensor Configuration (Lx500-800 models only) – at the Master boiler only, set the *Outdoor temperature source* equal to *Unconfigured*, via the *Sensor Configuration* menu as follows:

Configure – Sensor Configuration – Outdoor temperature source

Lead Lag Instructions – Domestic Hot Water

Tank Thermostat – connect to *SENSOR COM* and *DHW* of the Master Boiler; see *Field Wiring* Tables 12-2(a) and 12-2(b) 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* Figures and Tables 12-1(a) and 12-1(b). 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 Lx is 120V / 1 Phase / 60 Hz / 12A. The Trinity Lx line voltage junction box is located in the lower right corner of the boiler cabinet on models Lx150-200 and can be accessed by removing the front door of the boiler, followed by the removal of the line voltage junction box cover. On Lx300-400 models, the line voltage junction box is located at the top of the boiler cabinet on the right hand side and can be accessed by removing the top front cover of the boiler. On Lx500-800 models, the line voltage junction box is located at the back of the boiler cabinet on the power switch side. Remove the top back cover of the boiler to access the three holes / knockouts needed for routing field wiring into the line voltage junction box. Line voltage field connections are to be installed in accordance with Figures and Tables 12-1(a) and 12-1(b).

Fuses (120VAC) – The Trinity Lx is equipped with either one or two 7 Amp fuses to protect 120VAC system components. The fast-acting fuses are located on the front of the control panel box and can be easily accessed from the outside of the control panel.

Lx150-400 Control Panel:

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

Lx500-800 Control Panel:

- Fuse A: Protects the 120VAC circuits within the boiler.

Pump Relays (Lx500-800) – In lieu of the 120VAC pump outputs, the Lx500-800 incorporates three non-powered isolation relay contacts for switching high capacity pumps. Contact Secondary Maximum rating is 1.5HP @ 120V, 3.0HP @ 240V, or 30A. Refer to Figure 12-2(b) for Field Wiring requirements.

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 Lx 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 – Lx150-400 circulator outputs 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(a) Line Voltage Field Wiring (Lx150-400)

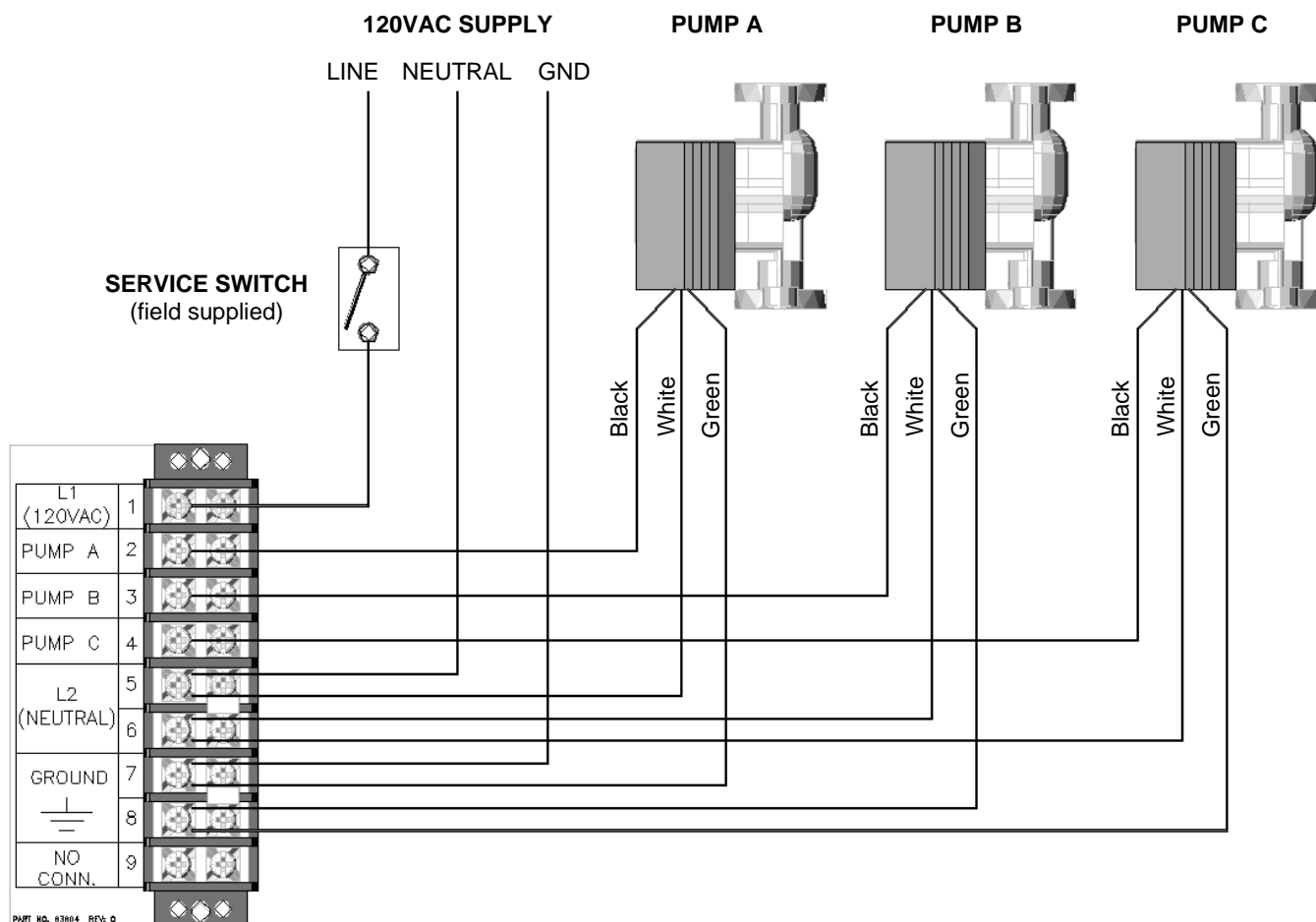


Table 12-1(a) Line Voltage Field Connections (Lx150-400)

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 boiler.
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	
No Conn.	9	This terminal is used only for factory wiring, do not add or remove wires from this location.

Figure 12-1(b) Line Voltage Wiring (Lx500-800)

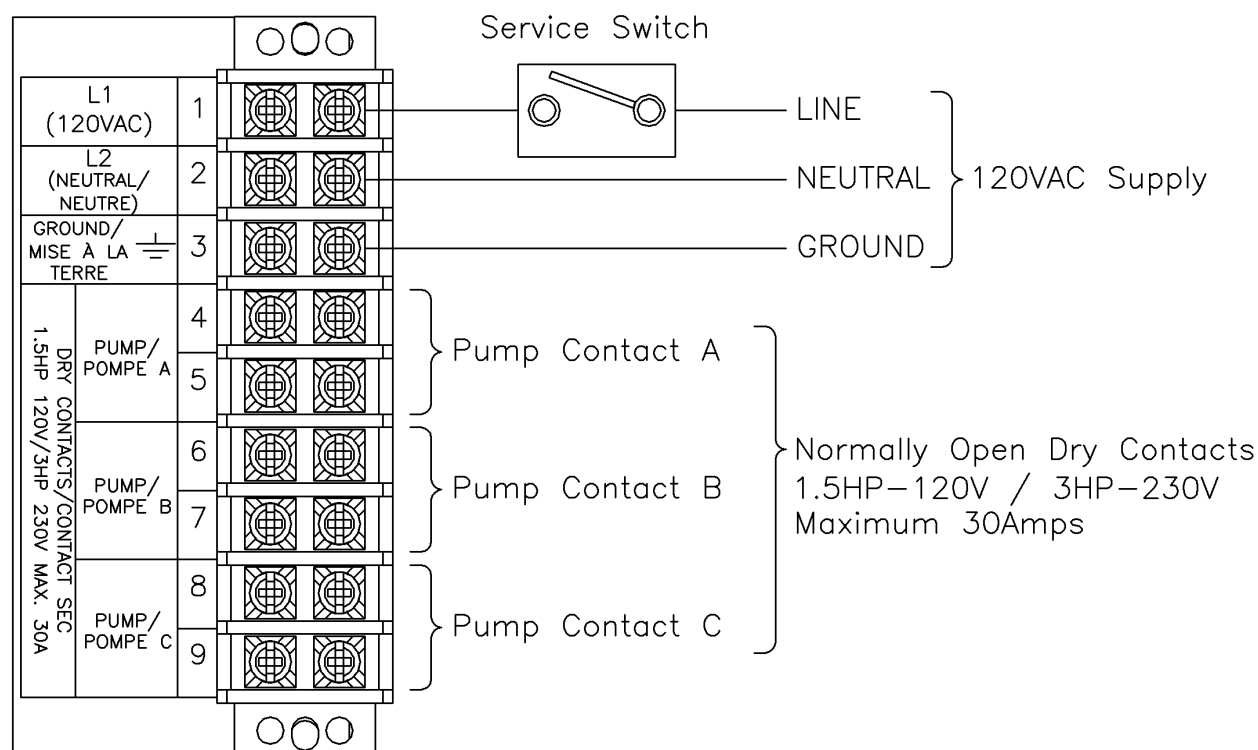


Table 12-1(b) Line Voltage Field Connections (Lx500-800)

Table 12-1(b) Line Voltage Field Connections (240V/336V)			
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 boiler.
L2 (Neutral)		2	Location for connecting neutral of the power supply.
Ground		3	Location for connecting earth ground.
Non-Powered Dry Contacts	PUMP A	4	Dry Contacts for DHW circulator; Coil A powered during a demand for DHW, closing Pump A relay contacts.
		5	
	PUMP B	6	Dry Contacts for Boiler circulator; Coil B powered during all demands; DHW, local Central Heat (CH1) and Lead-Lag Central Heat [CH2 (LL)], closing Pump B relay contacts. This output is not used for all plumbing configurations, see Section 2.0.
		7	
	PUMP C	8	Dry Contacts for Central Heating circulator; Coil C powered during a demand for local Central Heat (CH1) or Lead-Lag Central Heat [CH2 (LL)], closing Pump C relay contacts.
		9	

Low Voltage Connections

The Trinity Lx low voltage junction box is located in the lower left corner of the boiler cabinet on Lx150-200 models and can be accessed by removing the front door of the boiler, followed by the removal of the low voltage junction box cover. On Lx300-400 models, the low voltage junction box is located at the top of the boiler cabinet on the left hand side and can be accessed by removing the top front cover of the boiler. On Lx500-800 models, the low voltage junction box is located at the back of the boiler cabinet and can be accessed by removing the top back cover of the boiler. Each boiler is provided with one hole and two knockouts for routing field wiring into the low voltage junction box. Low voltage field connections identified in Tables 12-2(a) and 12-2(b) are to be read in conjunction with Figure 12-2.

Table 12-2(a) Low Voltage Field Connections (Lx150-400)

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 LWCO, 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.
Sensor	DHW	7	DHW Tank Demand – Input requiring closure of terminals 7 and 10 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 Tank Sensor (P/N 84632), see Appendix A. (NOTICE: tank sensor cannot be used for cascade boiler arrangements).
	OD SENSOR	8	Outdoor Temperature Sensor – A wall mountable OD Sensor is included with each boiler. When connected to terminals 8 and 10, the control will indicate the outdoor temperature and adjust the boiler temperature set point during a Central Heat demand.
	SYSTEM	9	System Water Temperature – An optional strap-on System Sensor is available from NTI (P/N 84010). When connected to terminals 9 and 10, the control will indicate a “CH” or “Lead-Lag” temperature. The control can be set to use the System Sensor as the Modulation Sensor for a CH1 or Lead Lag demand; see Appendix A.
	SENSOR COM	10	System Common – Common port for field inputs DHW, OD Sensor, System Sensor and Communication terminals.
4-20mA		11	External Modulation Control – Using a 4-20mA signal, 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.
		12	
Communications	LL DATA+	13	Lead-Lag – Connects internally to the controller’s MB2, Modbus communication port. Terminals 13, 14 and 10 (common) can be “daisy-chained” to multiple boilers (up to 8 in total) for the purpose of staging.
	LL DATA–	14	
	BMS D+	15	Building Management System (BMS) – Connects internally to the display’s COM2, Modbus communication port. Terminals 15, 16 and 10 (common) can be connected to a Gateway for communication to a BMS or other device.
	BMS D–	16	
ALARM		17	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.
		18	

Table 12-2(b) Low Voltage Field Connections (Lx500-800)

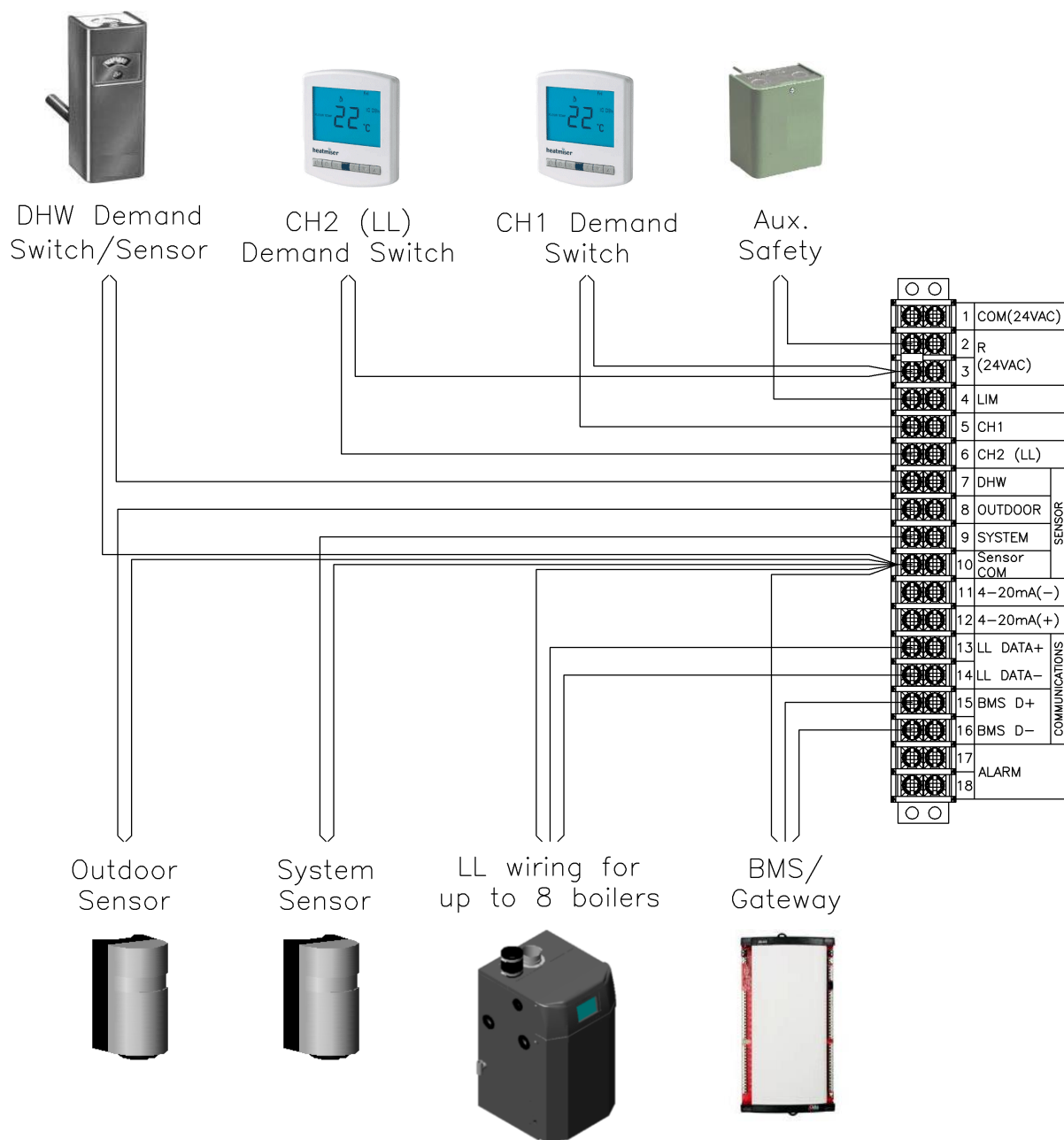
Connection		Location	Description
COM (24VAC)		1	24VAC Common – Neutral for the 24VAC power supply from the boiler. COM can be used in conjunction with terminal R to provide a power source for a digital thermostat.
R1/R2 (24VAC)		2	24VAC Hot - Power supply for inputs EXT. LIM, CH1, and CH2 (LL).
		3	
EXT. LIM		4	External Limit – Input requiring 24VAC from terminals R1/R2 to permit the burner to operate. Comes factory equipped with a jumper to the R2 terminal. For installations requiring the use of an additional safety switch, such as a LWCO or auxiliary temperature limit, remove the factory installed jumper and install the normally open isolated contacts of the field supplied additional limit in place of jumper.
GAS LO PR.		5	Gas Low Pressure Switch (Optional) – Comes factory equipped with a jumper. For applications requiring a Low Gas Pressure Switch, remove jumper and connect normally open isolated contacts of the Gas Low Pressure Switch. Switch must be installed external to unit (24VAC circuit). For preapproved High Gas Pressure Switch, see Note 1 below.
		6	
AUX. PROOF		7	Auxiliary Proof – Comes factory equipped with a jumper. For applications using Indoor Combustion Air, remove jumper and replace with field supplied end switch incorporated with motorized damper/louver control.
		8	
CH1		9	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)		10	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.
Sensor	DHW	11	DHW Tank Demand – Input requiring closure of terminals 11 and 14 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 Tank Sensor (P/N 84632), see Appendix A. (NOTICE: tank sensor cannot be used for cascade boiler arrangements).
	OD / SYS SENSOR	12	Outdoor Temperature Sensor – A wall mountable OD Sensor is included with each boiler. When connected to terminals 12 and 14, the control will indicate the outdoor temperature and adjust the boiler temperature set point during a Central Heat demand. System Water Temperature – An optional strap-on System Sensor is available from NTI (P/N 84010). When connected to terminals 12 and 14, the control will indicate a “Lead-Lag” temperature. By default, the System Sensor becomes the Modulation Sensor for a Lead Lag demand. NOTICE: only one sensor can be connected to terminal 12 (System OR Outdoor Sensor); see instructions in Appendix A.
	TOD	13	Time of Day (Night Time Setback) – Input requiring closure of terminals 13 and 14 to initiate TOD setback setting. Switch is made using an isolated end switch (dry contact) using a timer, BAS or other device. [TOD applicable to and available on Lx500-800 only]
	SENSOR COM	14	System Common – Common port for field inputs DHW, OD Sensor and System Sensor.
4-20mA (– / +)		15	External Modulation Control – Using a 4-20mA signal, 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.
		16	
Communications	LL DATA+	17	Lead-Lag – Connects internally to the controller’s MB2, Modbus communication port. Terminals 17, 18 and 14 (common) can be "daisy-chained" to multiple boilers (up to 8 in total) for the purpose of staging.
	LL DATA–	18	
	BMS D+	19	Building Management System (BMS) – Connects internally to the display’s COM2, Modbus communication port. Terminals 19, 20 and 14 (common) can be connected to a Gateway for communication to a BMS or other device.
	BMS D–	20	
ALARM (A&B)		21	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.
		22	
Notes ¹ For applications requiring a High Gas Pressure Switch, see supplemental instructions included with NTI High Gas Pressure Switch Kit, P/N 84094. Note that this is the only High Gas Pressure Switch that has been tested with the unit and preapproved for field installation within the boiler cabinet.			

CAUTION

Low Voltage Terminals - Terminals 2 and 3 (R) have 24VAC potential from the internal transformer. Do not connect power from these terminals 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

Fuse (24VAC) - Trinity Lx150-400 models are equipped with a “blade style” 2 Amp fuse to protect the internal transformer located within the slide-out control panel box.

Figure 12-2 Low Voltage Field Wiring (All Models)**Lx150-400 Illustrated**

13.0 WIRING SCHEMATICS

Figure 13-1(a) Connection Diagram (Lx150-400)

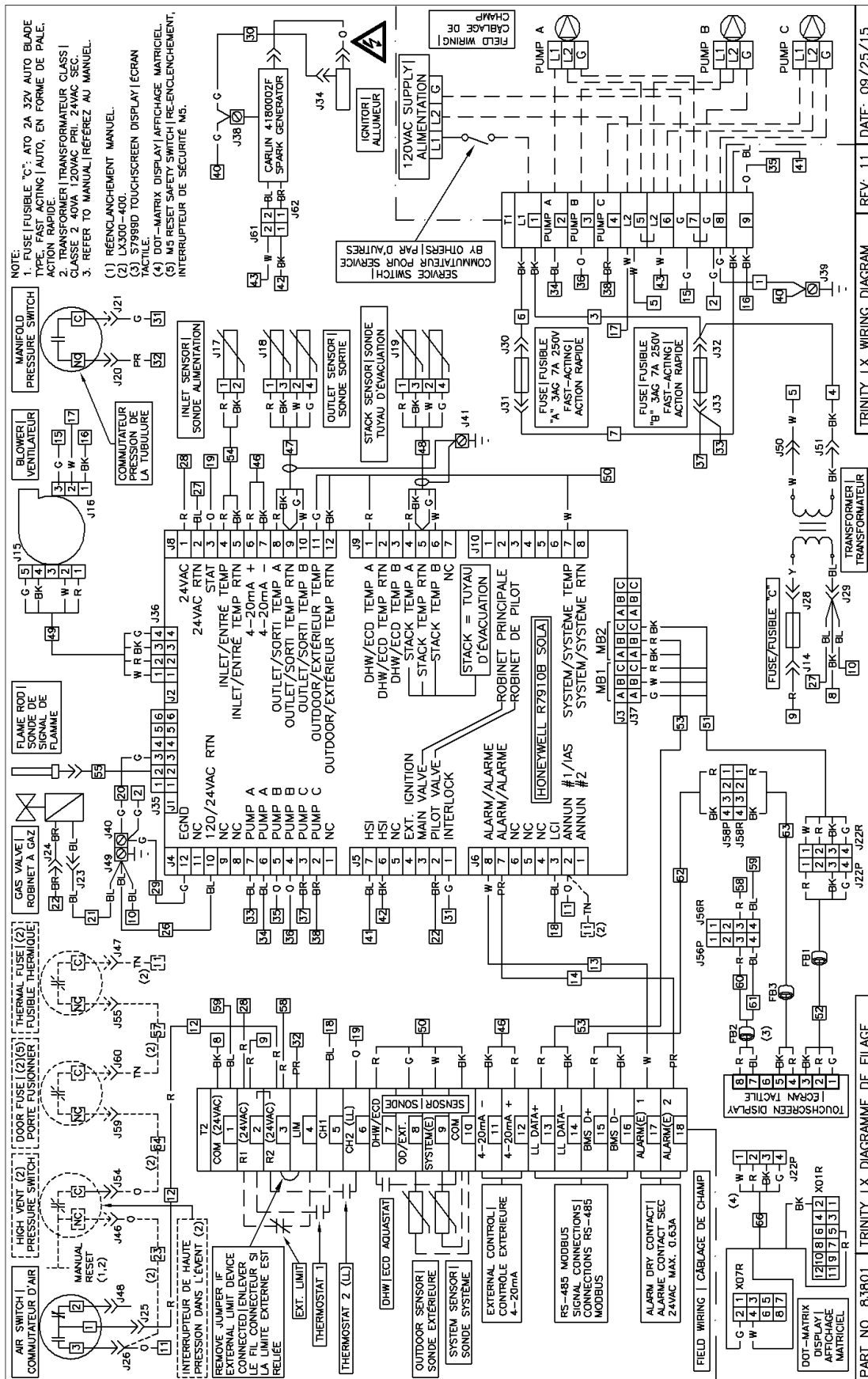


Figure 13-1(b) Ladder/Logic Diagram (Lx150-400)

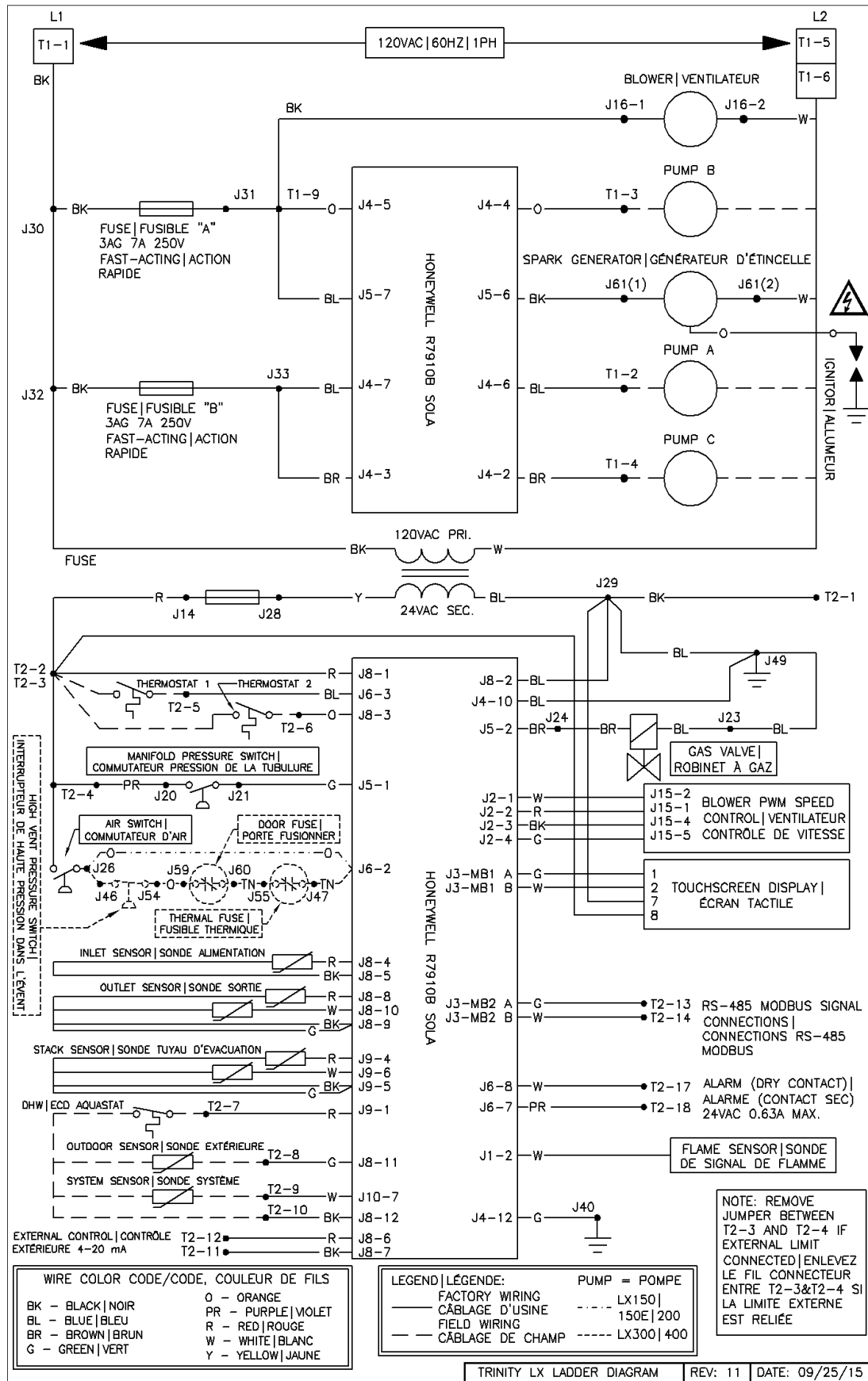


Figure 13-2(a) Connection Diagram (Lx500-800)

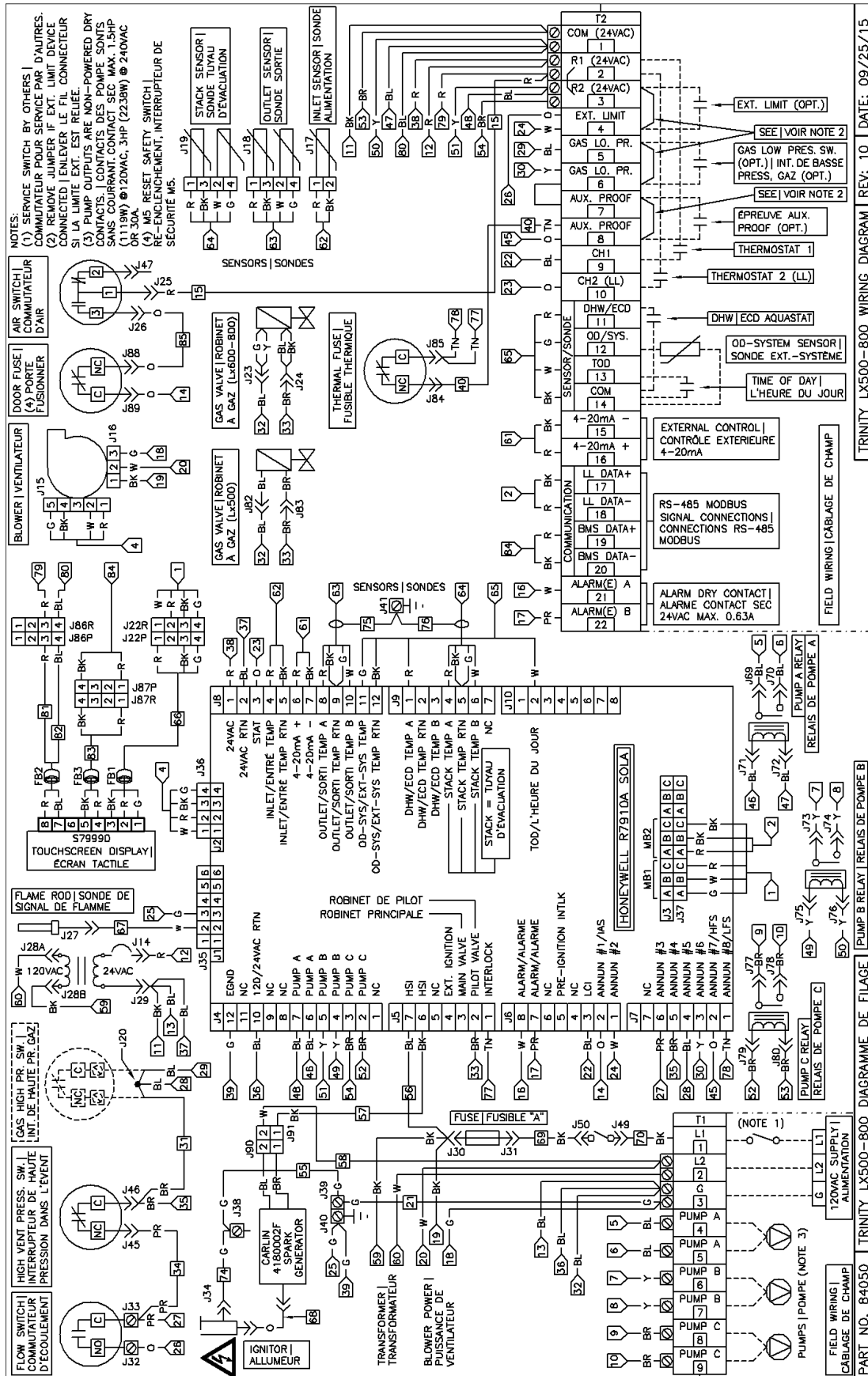
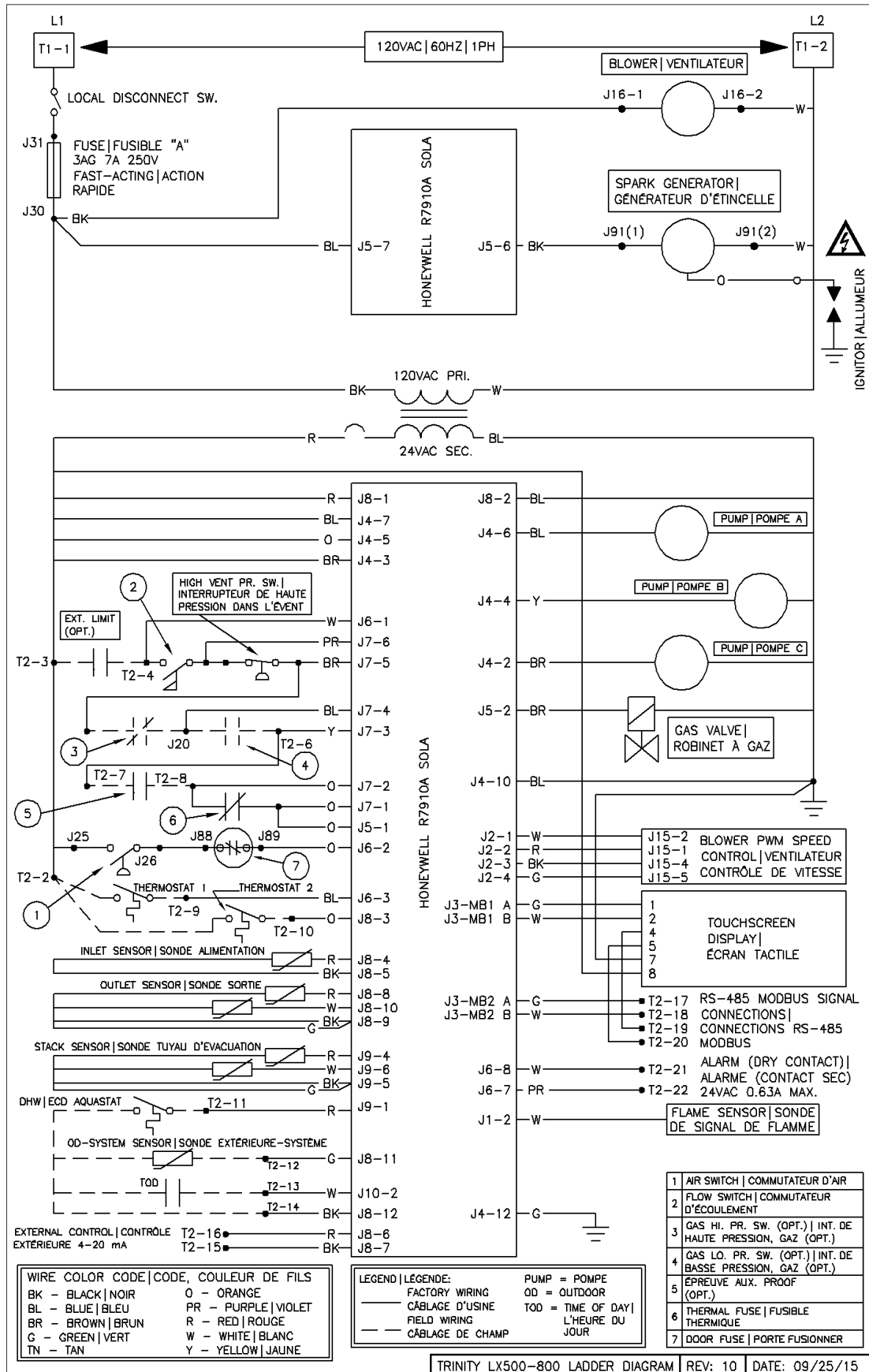


Figure 13-2(b) Ladder/Logic Diagram (Lx500-800)



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. Perform the **Mandatory Pre-commissioning Procedure for Plastic Venting** in Section 4.0.
- ☐ 4. Connect the condensate 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 the appropriate this Manual. Flush/cleanse the internals of the heating system. Treat system water with Fernox F1 Protector. See Table 10-1.
- ☐ 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.



The building owner is responsible for keeping the Vent/Air-inlet termination free of snow, ice, or other potential blockages and for scheduling routine maintenance on the boiler (see Section 15.0). Failure to properly maintain the boiler may result in serious injury or death.

Start-up



Allow primers/cements to cure for 8 hours prior to Start-up. If curing time is less than 8 hours, first perform 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 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.



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



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