# Trinity Lx - WH

**Model Numbers: Lx200WH - Lx800WH**
**Version Date: 2022-06-07**

## INSTALLATION AND OPERATION MANUAL FOR TRINITY Lx-WH WATER HEATER

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### HAZARD SYMBOLS AND DEFINITIONS

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

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

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

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

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

**⚠ WARNING** — This Water Heater 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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NTI # 85236

## Read Before Proceeding

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

### FOR YOUR SAFETY, READ BEFORE OPERATING

A) This water heater 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 water heater 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 water heater if any part has been under water. Immediately call a qualified service technician to inspect the water heater 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 water heater.
3. This water heater 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 water heater.
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 Water heater” and call your service technician or gas supplier.

### TO TURN OFF GAS TO THE WATER HEATER

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

**⚠ WARNING** **Crystalline Silica** - Certain components confined in the combustion chamber may contain this potential carcinogen. Improper installation, adjustment, alteration, service or maintenance can cause property damage, serious injury (exposure to hazardous materials) or death. Refer to Section 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 water heater. This water heater contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans).

**⚠ WARNING** **Void Warranty -** This Water heater 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 water heater 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 Water heaters ANSI/ASME CSD-1.

This document pertains to the correct installation and operation of NTI Trinity water heater models Lx200WH, Lx300WH, Lx400WH, Lx500WH, Lx600WH, Lx700WH and Lx800WH. 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 Manual,
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 water heater so it will safely operate with Propane Gas.

**⚠ DANGER** Models Lx600WH-Lx800WH 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.

### User Responsibilities

This water heater must be installed and serviced by a qualified installer or service technician. This water heater 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 water heater 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 water heater. The Installer assumes all responsibility for a safe installation and that it meets the requirements of the water heater 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.

**⚠ DANGER**

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

## ATTENTION: LIQUEFIED PETROLEUM (LP) PROPANE

Liquefied Petroleum (LP) propane gas is heavier than air; therefore, it is imperative that your 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 Gas to LP Conversion Kit**

| Model | Kit Part Number | LP-Orifice |
|---|---|---|
| **Lx200WH** | **82650-1** | **52 (5.2 mm)** |
| **Lx300WH** | **82650-1** | **62 (6.2 mm)** |
| **Lx400WH** | **83017-1** | **62 (6.2 mm)** |
| **Lx500WH** | **84386-1** | **No Orifice** |

**Notes:**
[1] Models Lx600WH, Lx700WH and Lx800WH are NOT convertible to Propane.

### Water Heater Vent / Air-Inlet Piping

**⚠ DANGER**

The Trinity Lx is certified as a "Category IV" water heater 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. If 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 water heater 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 water heater).*

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 water heater 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 water heater or equipment at the completion of the installation.

## 2.0 SPECIFICATIONS

**Table 2-1 General Specifications**

| DESCRIPTION | Lx200WH | Lx300WH | Lx400WH | Lx500WH | Lx600WH | Lx700WH Lx800WH |
|---|---|---|---|---|---|---|
| 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) | 125 | 180 | 225 | 320 | 380 | 475 |
| Water Content (gallons) | 1.2 | 2.1 | 2.4 | 3.3 | 4 | 5.2 |
| Electrical Rating | 120V / 1 Phase / 60 Hz / 12A | | | | | |

**Table 2-2(a) Water Heater Performance Specifications**

| DESCRIPTION | Lx200WH | Lx300WH | Lx400WH | Lx500WH | Lx600WH | Lx700WH | Lx800WH |
|---|---|---|---|---|---|---|---|
| CSA Input Modulation (MBH)[1] | 25 - 199 | 55 - 275 | 75 - 399 | 100 - 500 | 120 - 600 | 160 - 700 | 160 - 800 |
| Recovery Rating at 100°F Rise (GPH)[1,2] | 229 | 317 | 460 | 576 | 691 | 806 | 922 |
| Thermal Efficiency (%)[2] | 96 | | | | | | |

**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] 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].

**⚠ WARNING**

**Combustion** – At elevations above 2000 feet, the combustion of the water heater must be checked with a calibrated combustion analyzer to ensure safe and reliable operation. **It is the <u>Installers responsibility</u> to check the combustion and to adjust the combustion in accordance with Section 9.0.** Failure to follow these instructions may result in property damage, serious injury, or death.

## 3.0 WATER HEATER 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 water heater location.

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

### Floor Mounting

The Trinity Lx can be mounted directly on combustible flooring, except for carpeting. Installing the water heater on carpeting is not permissible. Ensure the water heater is mounted above any anticipated flood level. Models Lx200WH-Lx400WH come equipped with stationary, low-profile legs. Models Lx500WH-Lx800WH 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.

### Water heater Area Ventilation Air Openings

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

**NOTICE** If the "Water heater Area" does not meet the recommended clearances listed in Table 3-1, and if the water heater area has a volume less than 150 $ft^3$, it is considered a Closet or Alcove. PVC vent pipe and fittings shall not be used within the closet or alcove; only approved CPVC, Polypropylene or Stainless-Steel vent pipe and fittings can be used. See Table 4-3 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 Lx500WH-Lx800WH), 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 $in^2$ per 1000 Btu/hr, but not less than 100 $in^2$ and within 6" of the top and bottom of the closet door. See Table 3-1for 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 water heater and the room is at least three (3) times the size of the alcove. Provided these conditions are met, the water heater requires no extra ventilation air openings to the space. See Table 3-1for minimum recommended clearances.

### Residential Garage Installations

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

### Wall Mounting Installations (Optional)

Lx200WH-Lx400WH models are shipped with wall mounting brackets to provide installers with the option of wall mounting the water heater. Lx500WH-Lx800WH 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 (Lx200WH)**

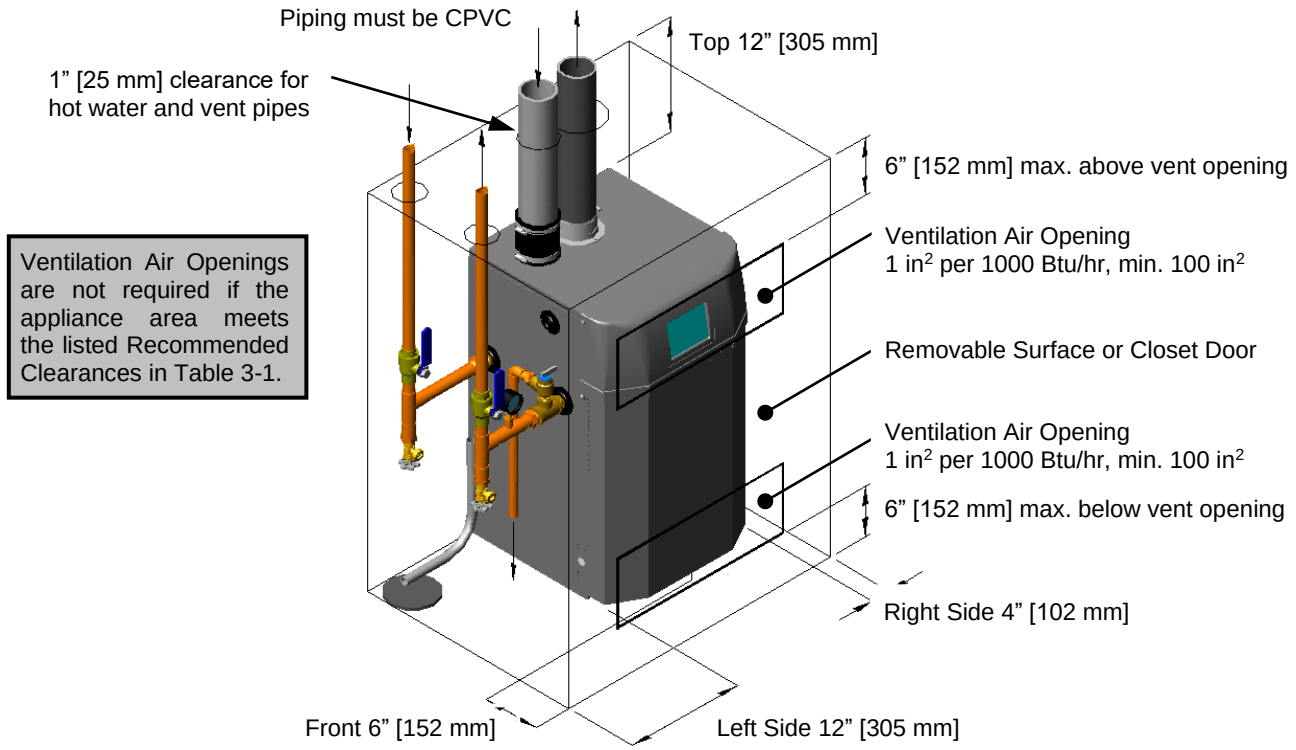
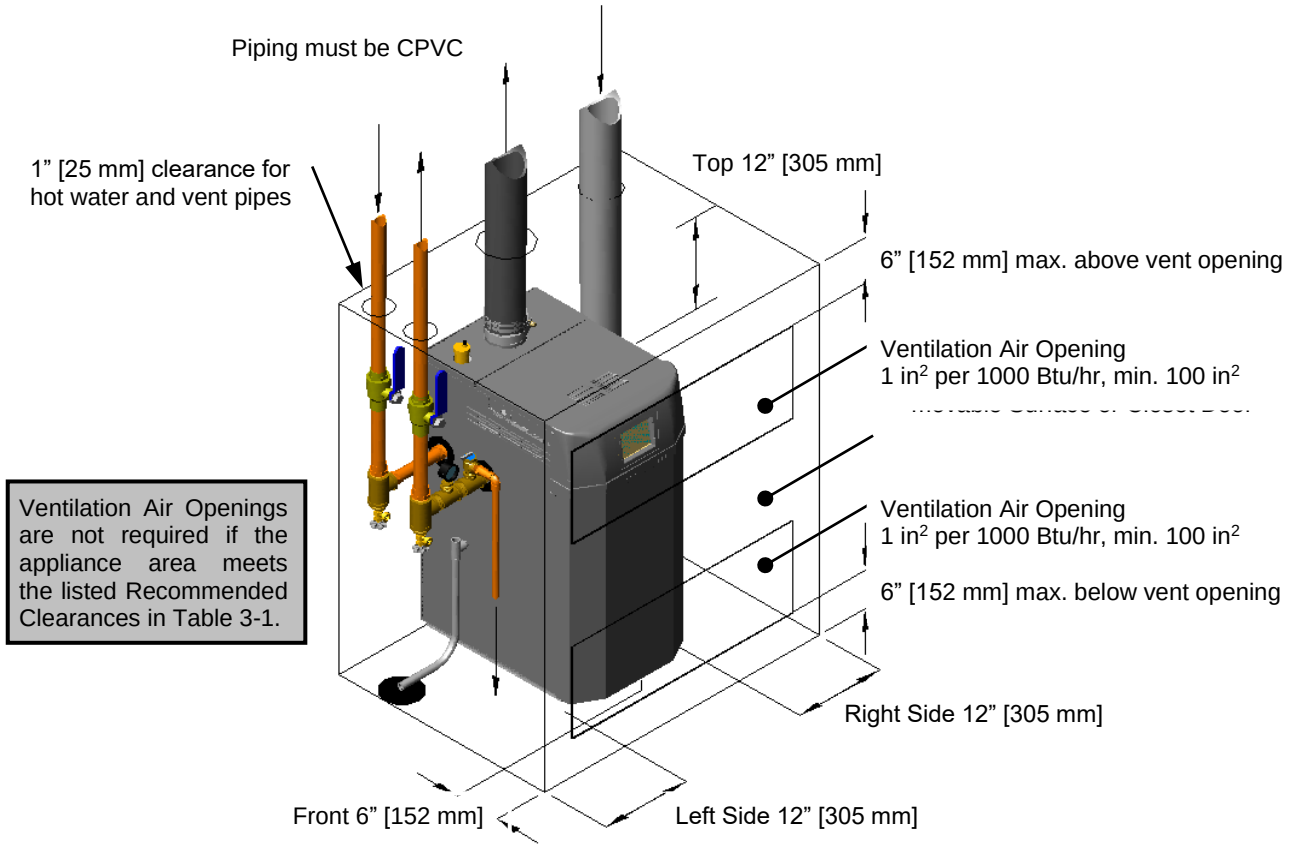



**Figure 3-1(b) Closet Installation, Minimum Clearances (Lx300WH & Lx400WH)**




**⚠ 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 (Lx500WH-Lx800WH)**

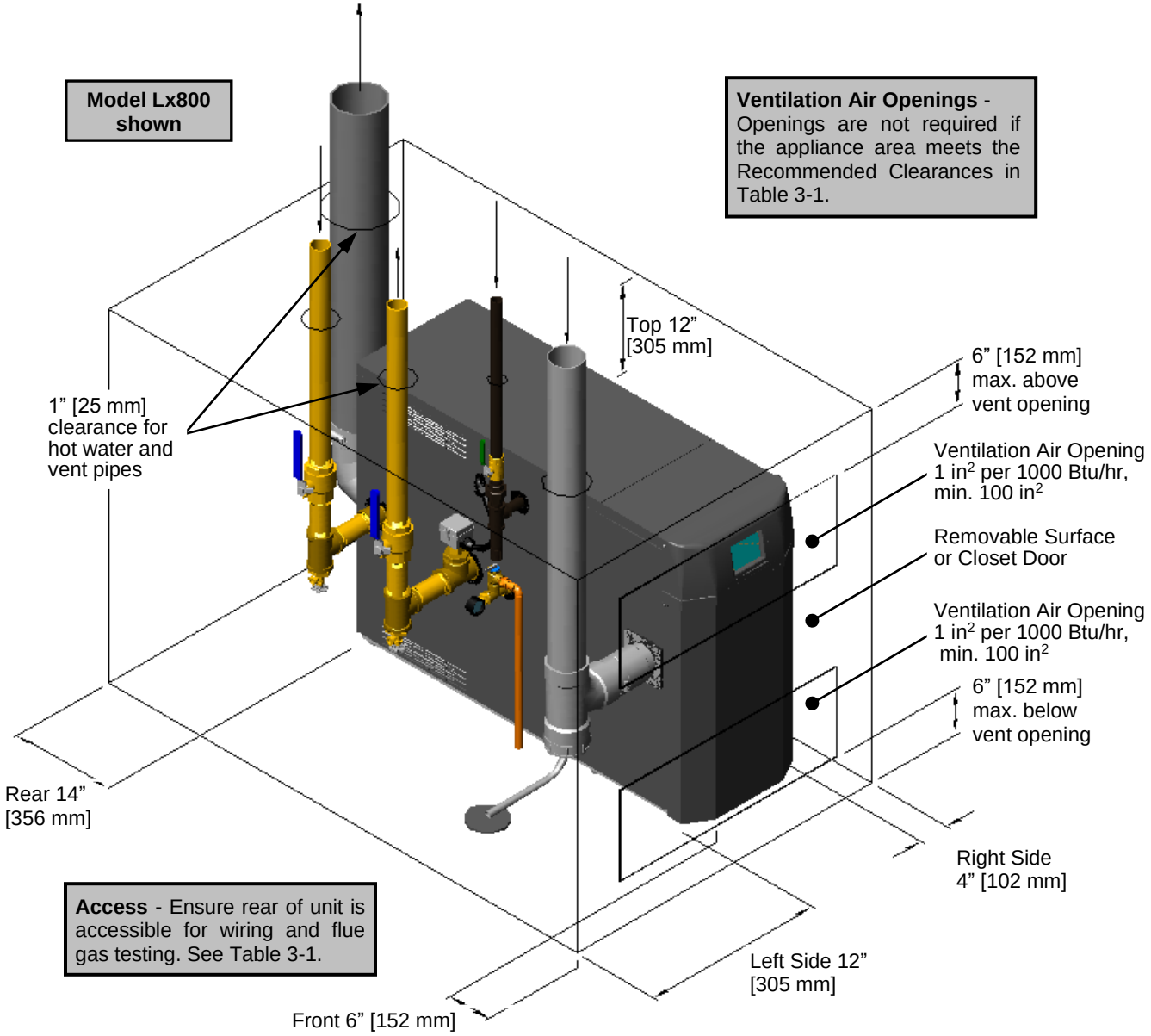



**Table 3-1 Minimum Clearances for Installation and Service**

| Model No. | Clearances | Dimensions - inches | | | | | |
|---|---|---|---|---|---|---|---|
| | | Front | Top | Left Side | Right Side | Rear | Flue Pipe |
| Lx200WH | Minimum | 24[1] | 12 | 12 | 4 | 0[4] | 1 |
| | Recommended | 24 | 24 | 24[2] | 4 | 0[4] | 1 |
| Lx300WH & Lx400WH | Minimum | 24[1] | 12 | 12 | 12 | 0[4] | 1 |
| | Recommended | 24 | 24 | 24[2] | 12 | 0[4] | 1 |
| Lx500WH-Lx800WH[3] | Minimum | 24[1] | 12 | 12 | 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 Lx500WH-Lx800WH, ensure rear of unit is accessible for wiring and flue gas testing.
[4] Code requires all wall mounted instantaneous water heaters to be installed with suitable wall protection extending the full length and width of the water heater. Check with local authorities regarding acceptable protection materials.

**Figure 3-2(a) Wall Mounting Installations (Lx200WH)**

❶ Remove the upper wall mount bracket from the back of the water heater.

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 water heater. Ensure the bracket is mounted in the level position. Refer to Table 2-1 Specifications for water heater weight.

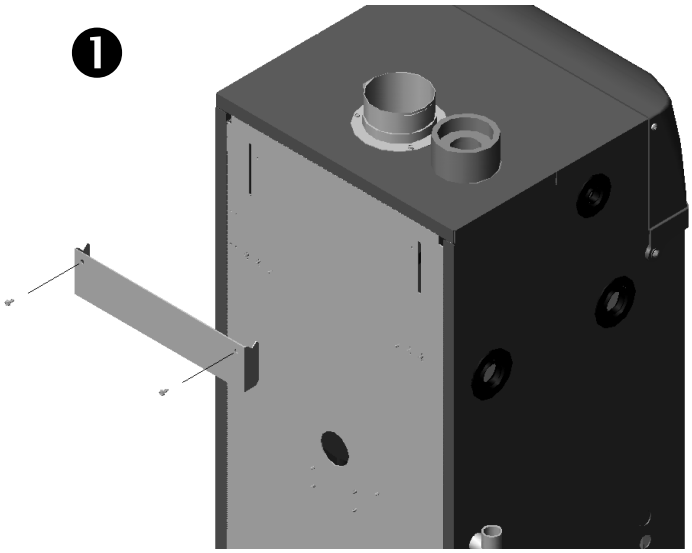
❸ Mount the water heater to the bracket by aligning the slots in the back of the water heater with the hooks protruding from the wall bracket. The top of the slots must rest at the bottom of the groove in the hooks of the wall mount bracket.

❹ Pull the bottom of the unit away from the wall to allow the installation of the lower wall mount bracket (included with water heater). 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).

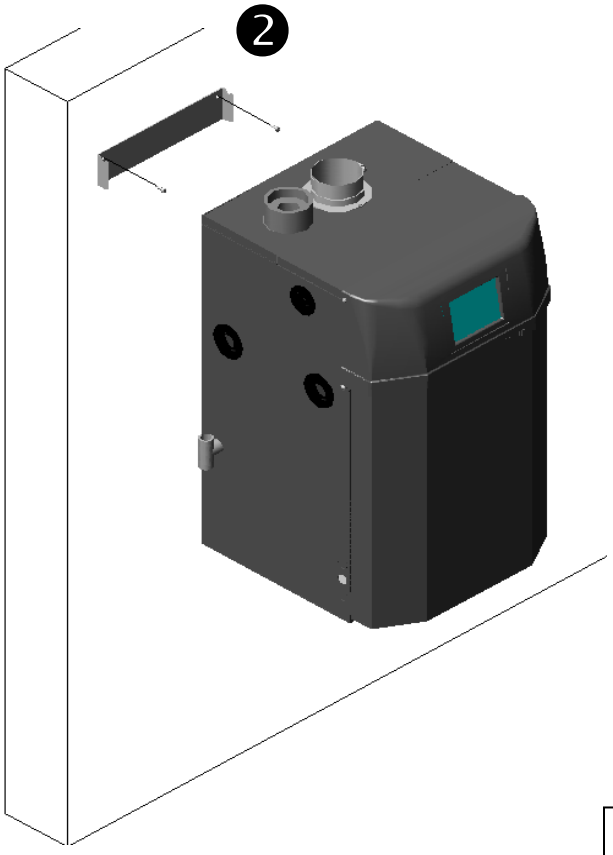
**⚠ WARNING** Failure to follow instructions may result in fire, serious injury, or death.

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

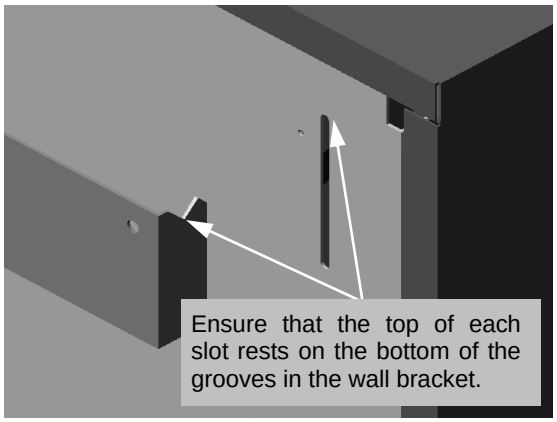
❶



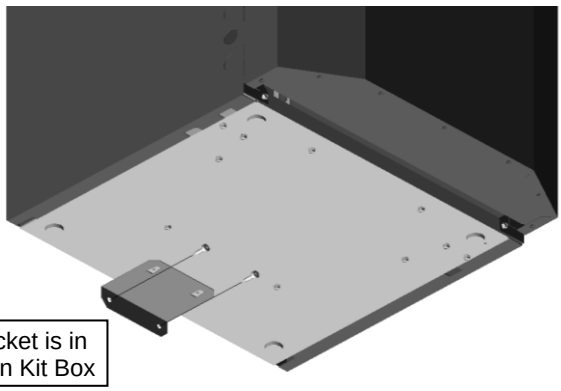
❷



❸




❹



Bottom Bracket is in Lx Installation Kit Box

**IMPORTANT** Code requires all wall mounted instantaneous water heaters to be installed with suitable wall protection extending the full length and width of the water heater. Check with local authorities regarding acceptable protection materials.

**Figure 3-2(b) Wall Mounting Installations (Lx300WH-Lx400WH)**

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.

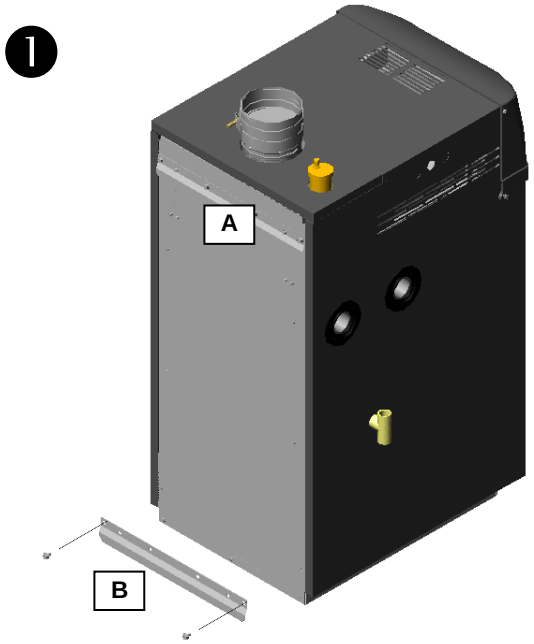
❷ Secure the wall mount bracket, removed from the bottom of the boiler in Step 1, to a solid wall using field supplied lag screws (anchors when mounting to a concrete wall) that are adequate to support the weight of the boiler (refer to Table 2-1 Specifications). Ensure the wall mount bracket is mounted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

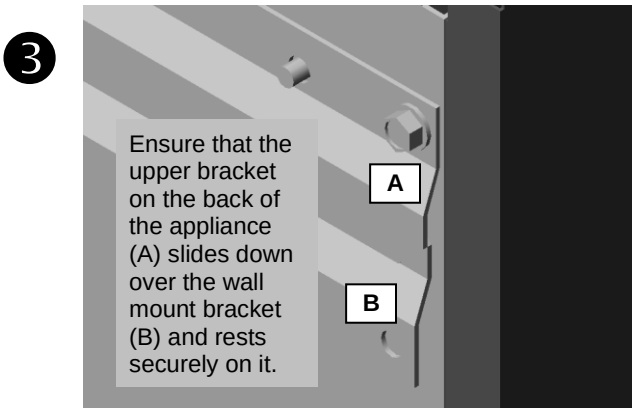
❸ Mount the boiler to the wall by aligning the upper bracket (A) with the wall mount bracket (B). Slide the upper bracket down over the wall mount bracket until it hooks.

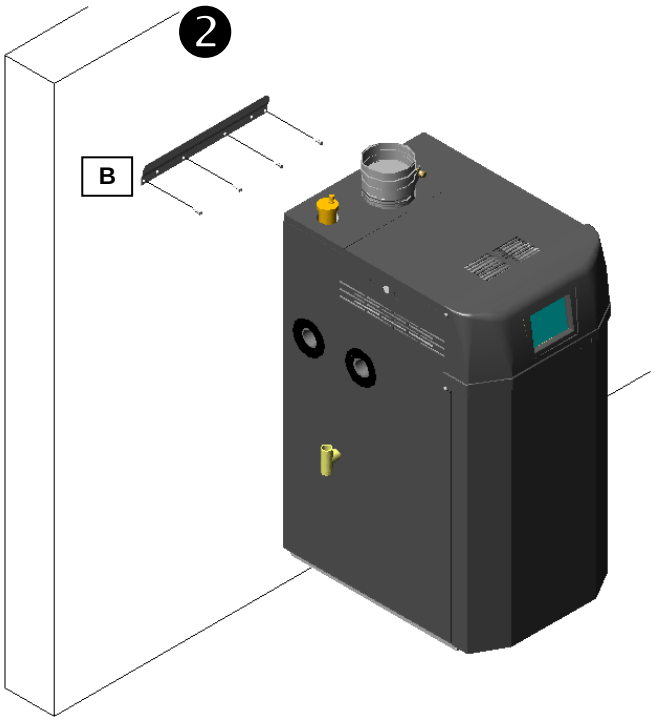
❹ Once the boiler is resting securely on the upper bracket, secure the bottom bracket to the underside of the boiler using the mounting hardware removed in Step 1; then, anchor the bottom bracket to the wall as shown.

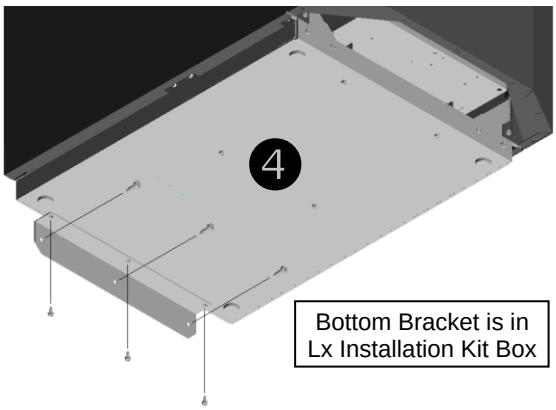
**⚠ WARNING** Failure to follow instructions may result in fire, serious injury, or death.

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




**IMPORTANT** Code requires all wall mounted instantaneous water heaters to be installed with suitable wall protection extending the full length and width of the water heater. Check with local authorities regarding acceptable protection materials.

## 4.0 GENERAL VENTING

The Trinity Lx is certified as a "Category IV" water heater 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.

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

**⚠ DANGER** 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 Water heater from Common Venting System

**⚠ DANGER** 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.

**⚠ WARNING** When an existing water heater 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 water heater 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 water heater, 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 Water Heater**

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 water heater being inspected. Follow the lighting instructions. Adjust thermostat so water heater 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 Lx200WH-Lx400WH)

When installed as a Direct Vent water heater 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 Lx500WH-Lx800WH)

When the installation uses Indoor Combustion Air (i.e. piping is not directly connecting the water heater 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 water heater shall be located so as not to interfere with proper circulation of combustion, ventilation, and dilution air.

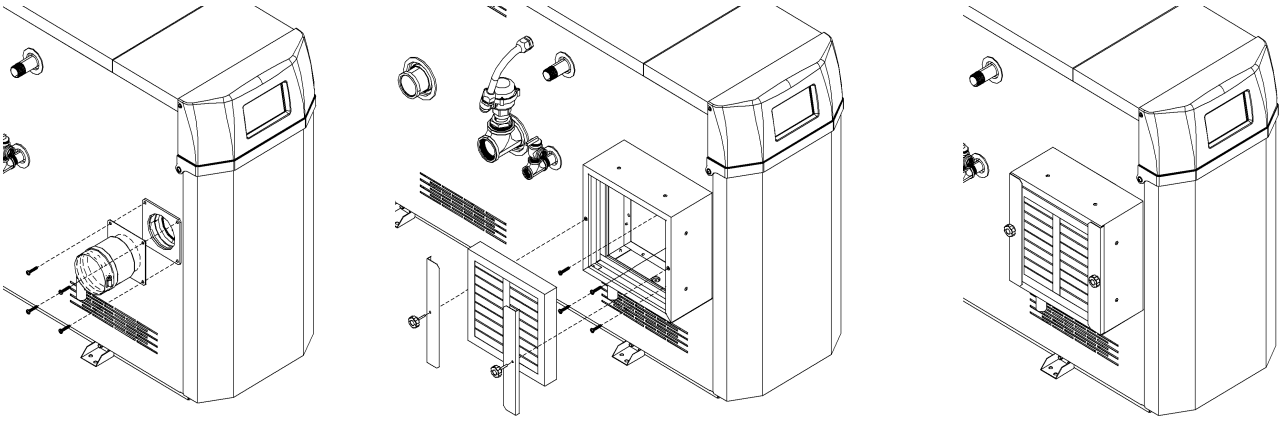
**⚠ WARNING** Make up air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements. Failure to ensure adequate make up air to all appliances may result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

**NOTICE** **Controller RPM Adjustments** – To avoid the potential water heater 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 water heater models Lx500WH-Lx800WH, 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 Lx500WH & Lx600WH, 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)**



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

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

❸ 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 water heater 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 water heater, 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 water heater 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 another conductor. Refer to warning regarding Spark Igniter Cable.
4) Turn power on to the water heater 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 Water Heater 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 water heater 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 water heater flue outlet adapter (see Table 4-2). Ensure that the venting system does not apply a load or strain on the water heater 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.

⚠ WARNING

**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.

⚠ WARNING

**PVC Exhaust Venting** – **DO NOT** insert PVC pipe directly into the water heater 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 water heater 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 |
|---|---|---|---|
| Lx200WH | 3" | Minimum 5" [127 mm] | 2-7/8" [73 mm] |
| Lx300WH-Lx600WH | 4" | Minimum 4" [100 mm] | 1-7/8" [48 mm] |
| Lx700WH & Lx800WH | 6" | Minimum 6" [152 mm] | 2-1/2" [63 mm] |

⚠ WARNING

**Polypropylene or Stainless-Steel Venting** – When using Polypropylene or Stainless-Steel piping, the appropriate water heater adapters must be used to transition the water heater 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 Water heater Adapters for Polypropylene and Stainless Steel Venting**

| Model No. | Vent Material | Venting Brand | Adapter Part No. [1,2] |
|---|---|---|---|
| Lx200WH | Polypropylene | DuraVent – PolyPro | 300150 |
| | | Centrotherm - InnoFlue | ISANY0303 |
| | | Z-Flex – Z-Dens® | 2ZDCPVCG3 |
| | Stainless Steel | DuraVent – FasNSeal | 810005378 |
| | | Z-Flex – Z-Vent® | 2SVSTTA03 |
| Lx300WH-Lx600WH | Polypropylene | DuraVent – PolyPro | 300151 |
| | | Centrotherm - InnoFlue | ISAA0404 |
| | | Z-Flex – Z-Dens® | 2ZDCPVCG4 |
| | Stainless Steel | DuraVent – FasNSeal | 303631 |
| | | Z-Flex – Z-Vent® | 2SVSTTA04.5 |
| Lx700WH-Lx800WH | Polypropylene | DuraVent – PolyPro | 810004281 |
| | | Centrotherm - InnoFlue | ISAA0606 |
| | | Z-Flex – Z-Dens® | 2ZDCPVCG6 |
| | Stainless Steel | DuraVent – FasNSeal | 810005231 |
| | | Z-Flex – Z-Vent® | 2SVSTTA06 |

**Notes:**
[1] Listed boiler adapters are only approved for use with the respective venting brand venting.
[2] Appliance adapters are available from the respective vent pipe manufacturer.

⚠ DANGER

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

NOTICE

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

**Figure 4-2(a) Near Water Heater Venting (CPVC)**

**Model Lx200WH**

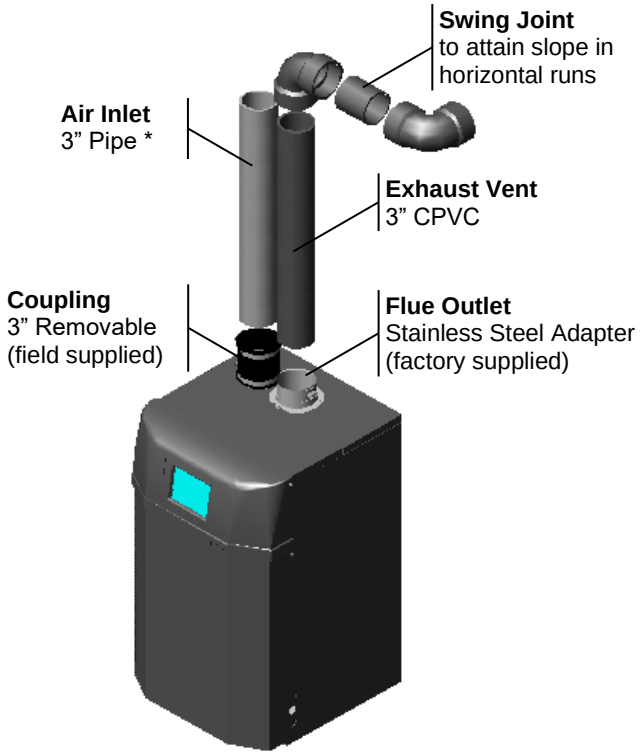



**Figure 4-2(b) Near Water Heater Venting (PVC)**

**Model Lx200WH**

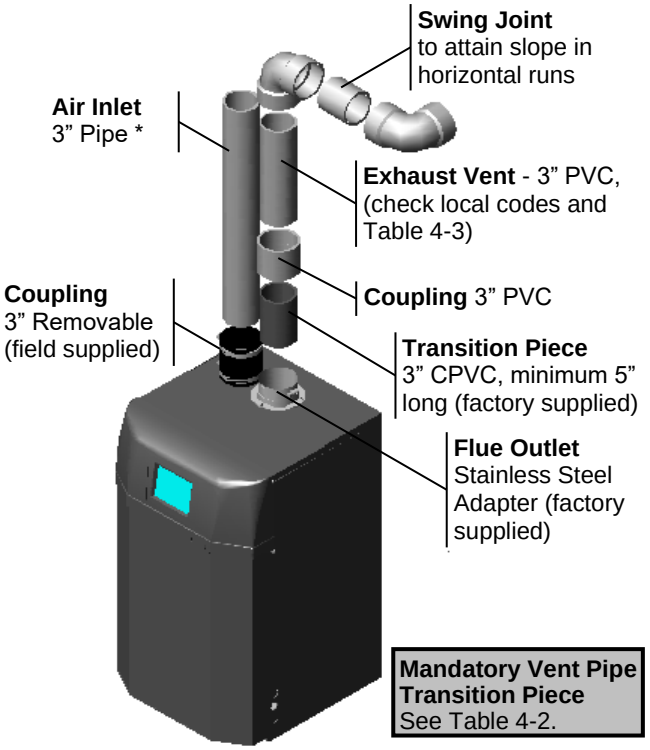



**Figure 4-3(a) Near Water Heater Venting (CPVC)**

**Models Lx300WH & Lx400WH**

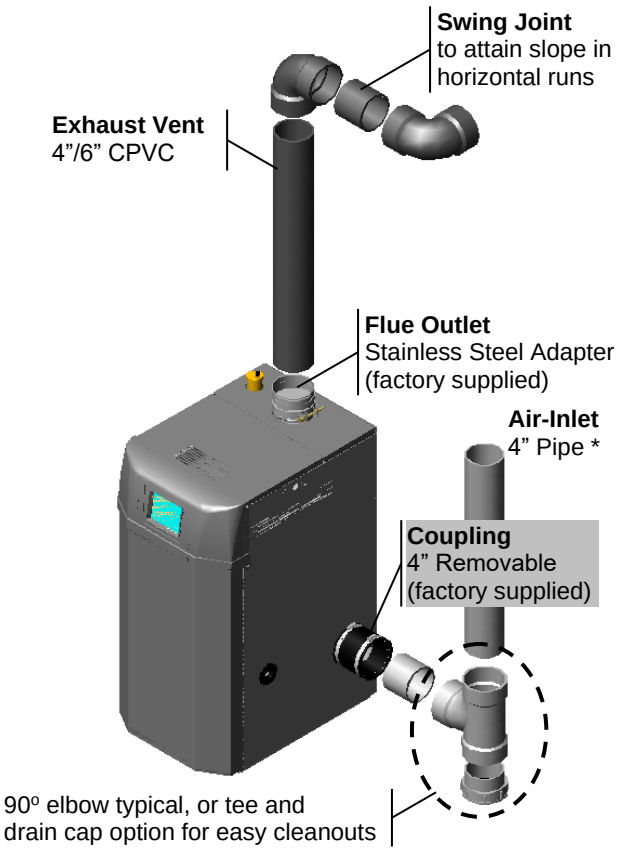
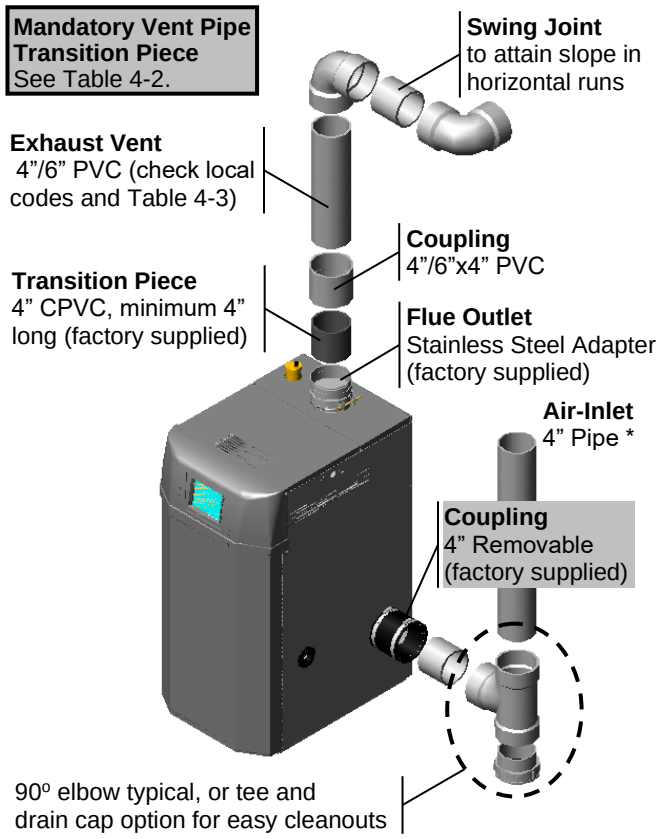



**Figure 4-3(b) Near Water Heater Venting (PVC)**

**Models Lx300WH & Lx400WH**




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

**Figure 4-4(a) Near Water Heater Venting (CPVC/PVC)**

**Models Lx500WH & Lx600WH**

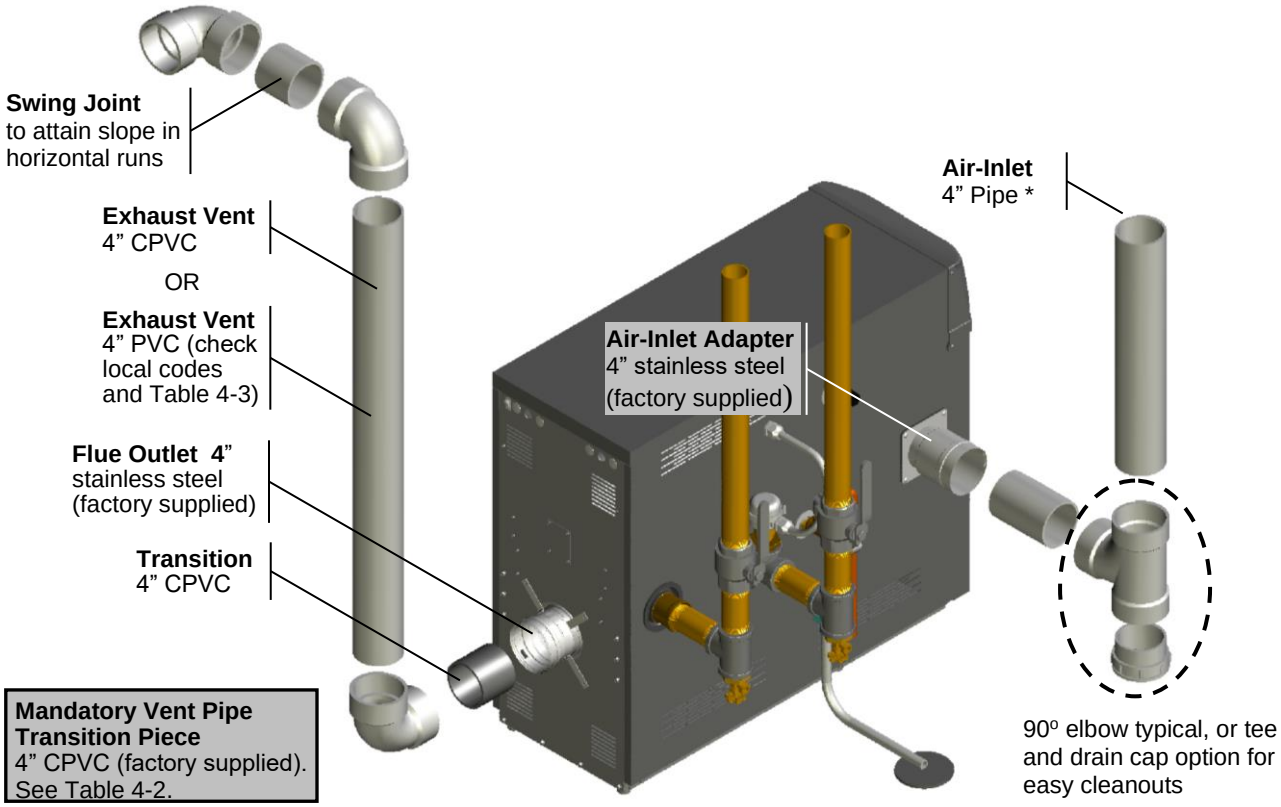



**Figure 4-5(a) Near Water Heater Venting (CPVC)**

**Models Lx700WH & Lx800WH**

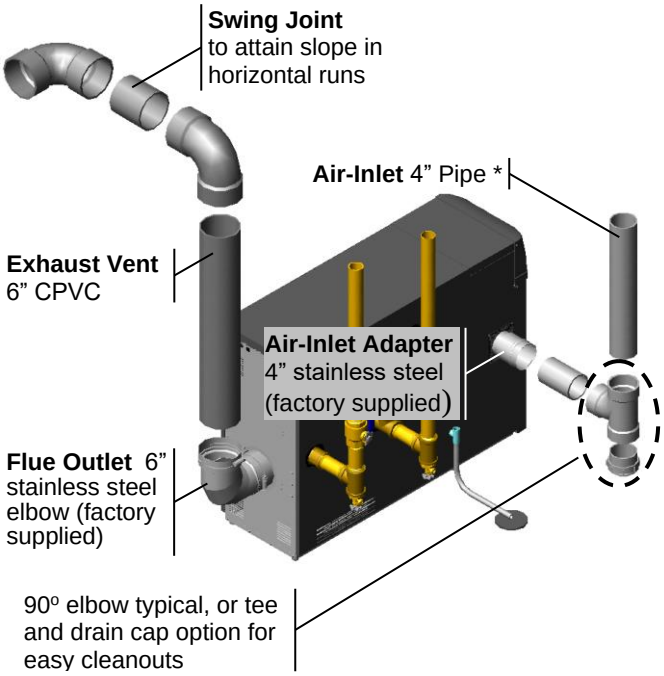
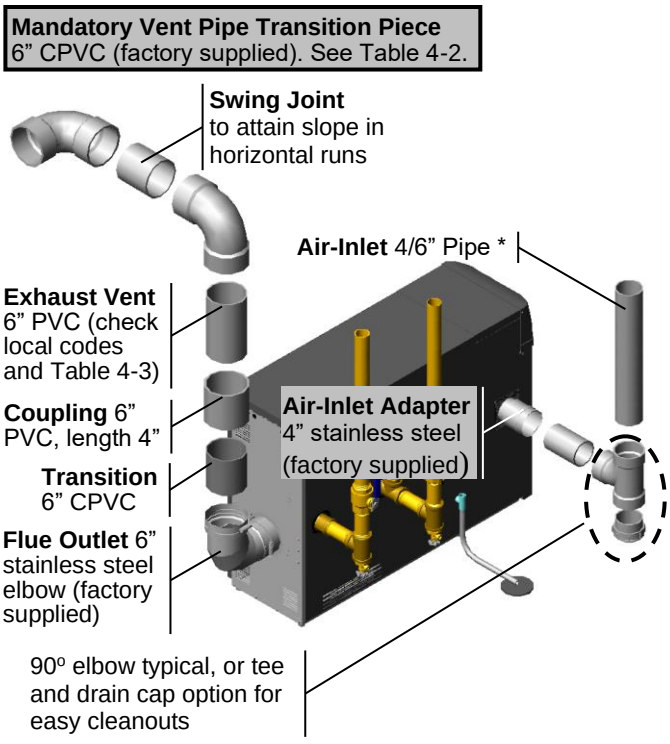



**Figure 4-5(b) Near Water Heater Venting (PVC)**

**Models Lx700WH & Lx800WH**




★ **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] | Venting System Standards | | WARNING |
|---|---|---|---|---|
| | | United States | Canada | |
| Vent Piping and Fittings | PVC – DWV Schedule 40/80 | UL-1738 or ANSI/ASTM D2665 | ULC S636 | All Exhaust and Air Intake materials installed on gas fired appliances in CAN/US must meet the specifications provided in this Table. Failure to comply could result in fire, serious injury or death. |
| | PVC Schedule 40/80 | UL-1738 or ANSI/ASTM D1785 | | |
| | CPVC Schedule 40/80 | UL-1738 or ANSI/ASTM F441 | | |
| | Stainless Steel (SS) | UL-1738 | | |
| | Polypropylene (PP) | UL-1738 or ULC S636 | | |
| Pipe Cement | PVC | ANSI/ASTM D2564 | | |
| | CPVC | ANSI/ASTM F493 | | |
| Primers | PVC / CPVC | ANSI/ASTM F656 | | |

**Notes:**
[1] Refer to Tables 4-5 for Allowable Exhaust and Air Intake 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; ABS and PVC Foam Core piping is acceptable. Check applicable local codes for acceptable materials.

**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.

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

### 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, 90º elbows, and 45º elbows at 5 equivalent feet each. Note: model Lx200WH has limitations when operating with Propane Gas (LP).

***Example*:** An Lx200WH 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 |
| Lx200WH | 3 in | LP | 50 | 45 | 40 | 35 | 30 | 25 | 20 | 15 | 10 | 5 |
| | 3 in | NG | 105 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 |
| | 4 in | NG & LP | 105 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 |
| Lx300WH & Lx400WH | 4 in or 6 in | NG & LP | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 |
| Lx500WH [3] | 4 in or 6 in | NG & LP | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 |
| Lx600WH [3] | 4 in or 6 in | NG [2] | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 |
| Lx700WH & Lx800WH [1] | 6 in | 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 Lx600WH-Lx800WH operate with Natural Gas only.
[3] Models Lx500WH & Lx600WH 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 Lx500WH & Lx600WH are limited to 30 equivalent feet of 4 in (or 90 equivalent feet of 6") exhaust vent when using the optional Air Filter Kit. When transitioning from 4 in to 6 in, the 4 in venting used must be counted 3 times to convert to an equivalent length in 6".

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

## Termination Options – Direct Vent Installation

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

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

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

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

| Description | Vent Size | Supplier P/N | Figure | Vent Material Compatibility | Vent Option | |
|---|---|---|---|---|---|---|
| | | | | | Roof | Wall |
| IPEX Low Profile (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 | | | | |
| PolyPro® Concentric (Wall) | 3” | 3PPS-HK | 4-9(d) | PolyPro® Polypropylene | × | ✓ |
| | 4” | 4PPS-HK | | | | |
| PolyPro® Concentric (Roof) | 3” | 3PPS-VK | 4-10(c) | | ✓ | × |
| | 4” | 4PPS-VK | | | | |
| InnoFlue® Flush Mount (Wall) | 3” | ISLPT0303 | 4-9 | InnoFlue® Polypropylene | × | ✓ |
| InnoFlue® Concentric (Wall)[9] | 3” | ICWS3513 & ICTC0335 | 4-9(d) | | × | ✓ |
| | | ICWT352 & ICTC0335 | | | | |
| | 4” | ICWS4639 & ICTC0446 | | | | |
| InnoFlue® Concentric (Roof)[9] | 3” | ICRT3539 & ICTC0335 | 4-10(c) | | ✓ | × |
| | 4” | ICRT4679 & ICTC0446 | | | | |
| Z-DENS® Horizontal Kit Low Profile (Wall) | 3” | 2ZDHKLP3 | 4-9 | Z-DENS® Polypropylene | × | ✓ |
| | 4” | 2ZDHKLP4 | | | | |
| Z-DENS® Concentric (Wall) | 3” | 2ZDHK3 | 4-9(d) | | | |
| | 4” | 2ZDHK4 | | | | |
| Z-DENS® Concentric (Roof) | 3” | 2ZDVK3 | 4-10(c) | | ✓ | × |
| | 4” | 2ZDVK4 | | | | |

**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 model Lx200WH.

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**
**(Lx200WH Illustrated)**

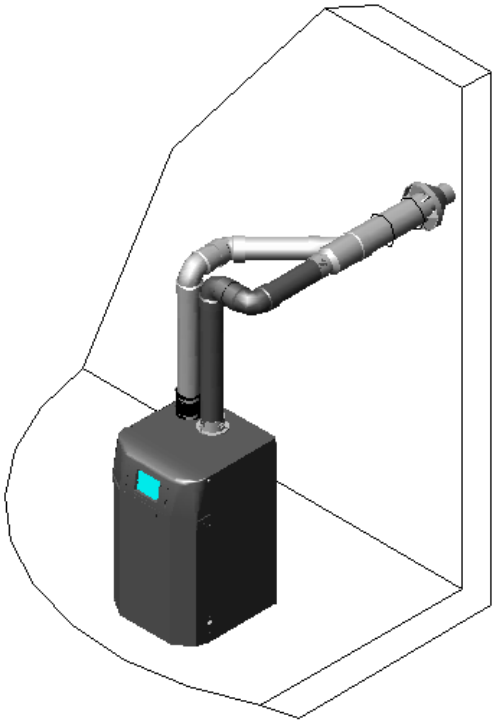


**Figure 4-6(b) Two-Pipe Sidewall Termination**
**(Lx200WH Illustrated)**

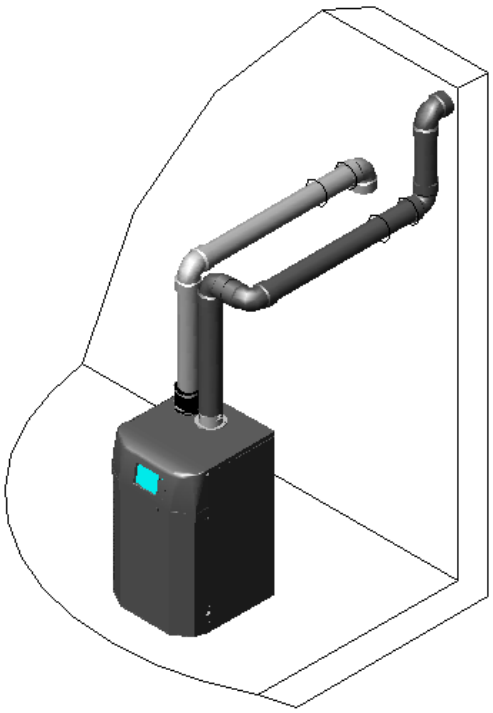


**Figure 4-7(a) Two-Pipe Sidewall Termination**
**(Lx800WH Illustrated)**

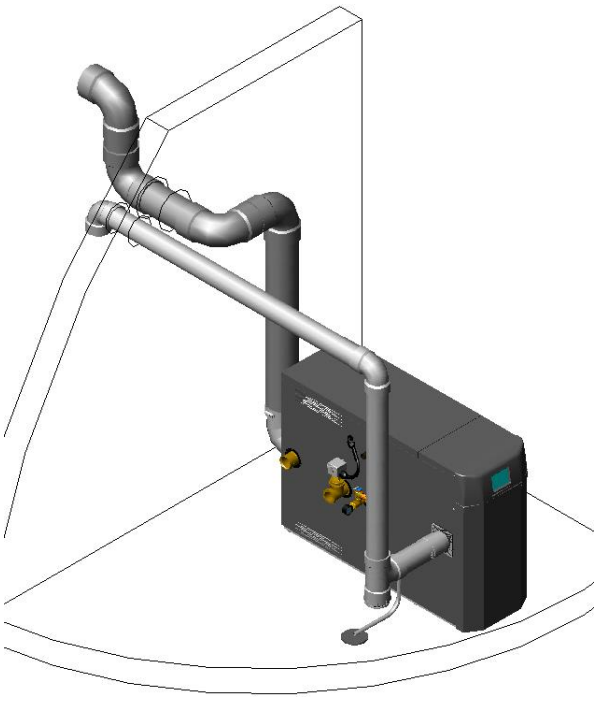
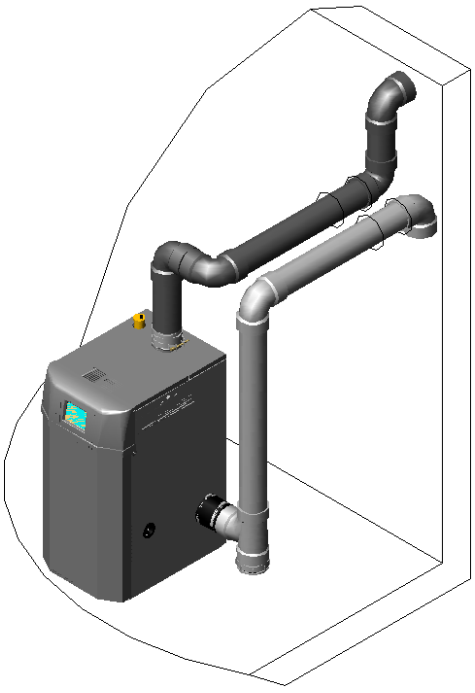


**Figure 4-7(b) Two-Pipe Sidewall Termination**
**(Lx400WH Illustrated)**



**⚠ WARNING**

Extra precaution must be taken to adequately support the weight of the Vent/Air-inlet piping in applications using roof-top terminations. Failure to follow these instructions may result in venting or water heater 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**
**(Lx200WH Illustrated)**

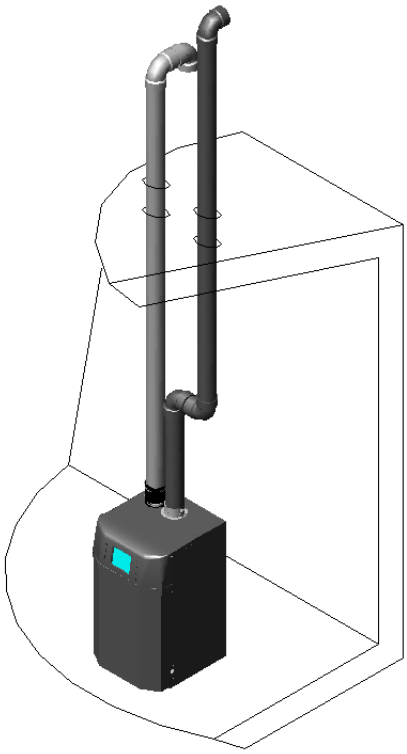
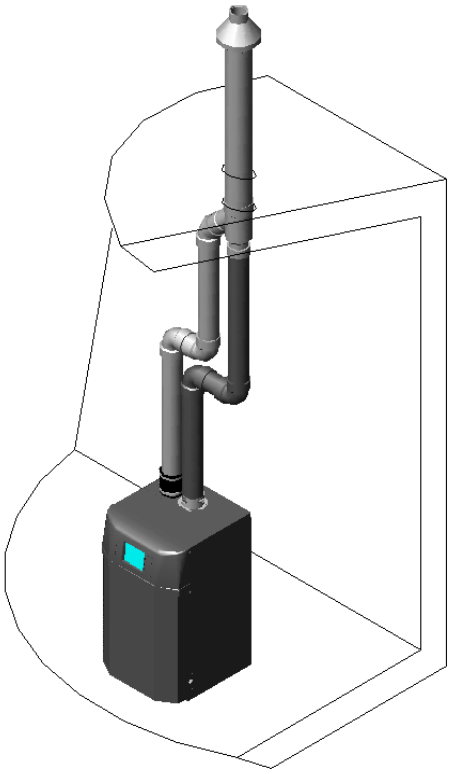


**Figure 4-8(b) Concentric Roof Termination**
**(Lx200WH Illustrated)**



## Sidewall Termination Details – Direct Vent Installation

**Figure 4-9(a)**

**Two-Pipe Termination (Sidewall)**

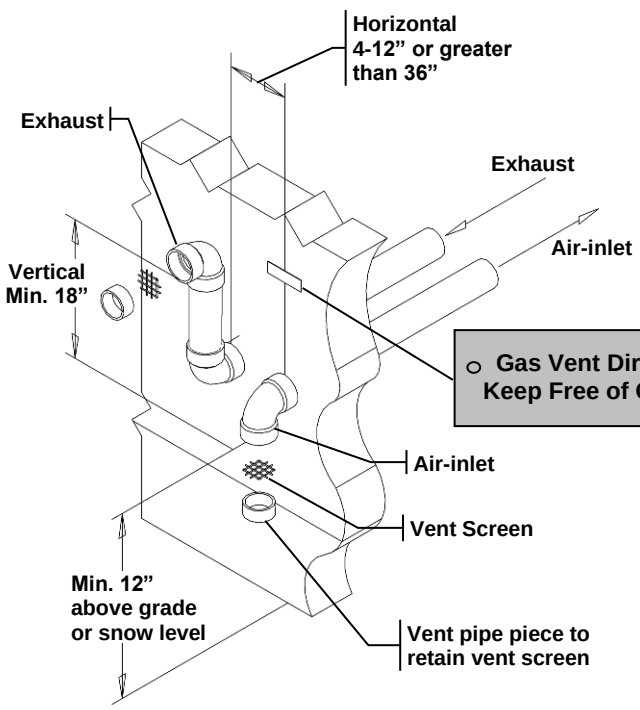



**Figure 4-9(b)**

**IPEX Concentric Termination (Sidewall)**

**⚠ WARNING**

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

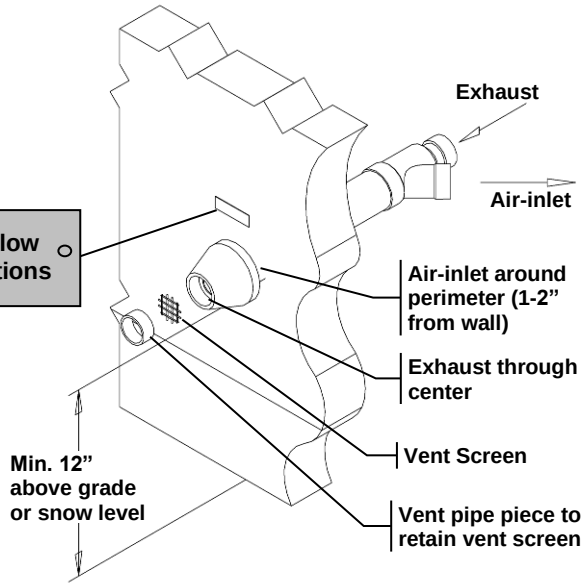



**Figure 4-9(c)**

**Low Profile Termination (Sidewall)**

**⚠ WARNING**

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

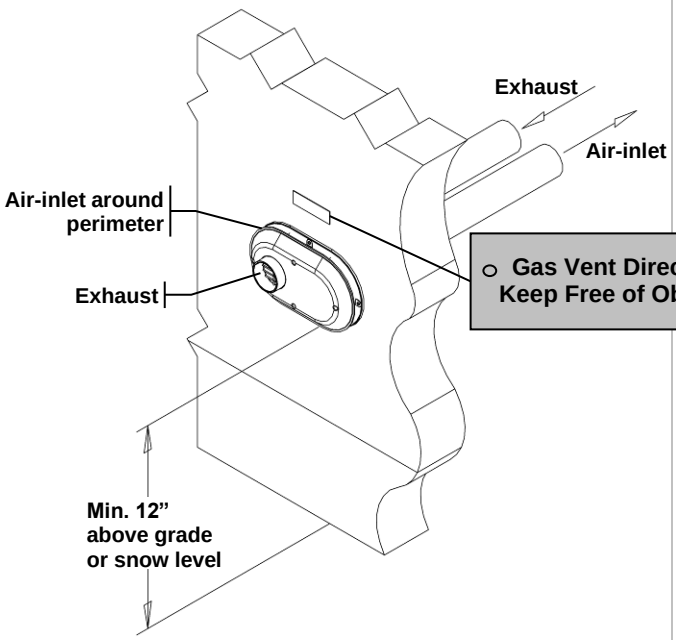
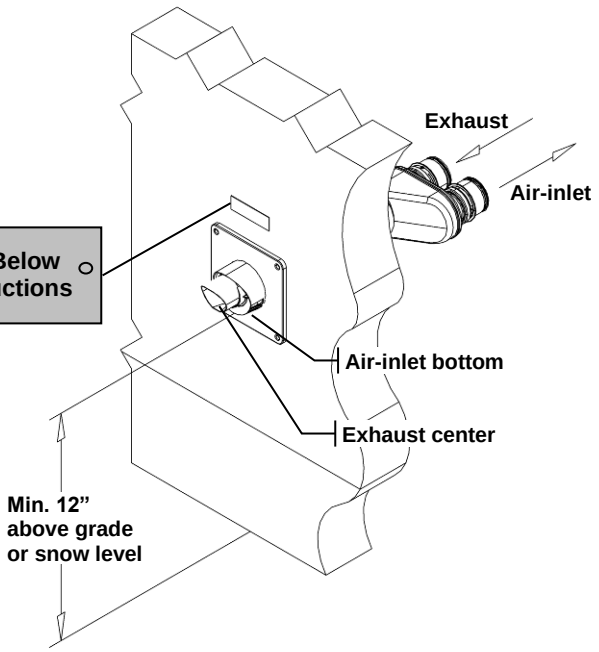



**Figure 4-9(d)**

**PolyPro / InnoFlue Termination (Sidewall)**

**⚠ WARNING**

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)**

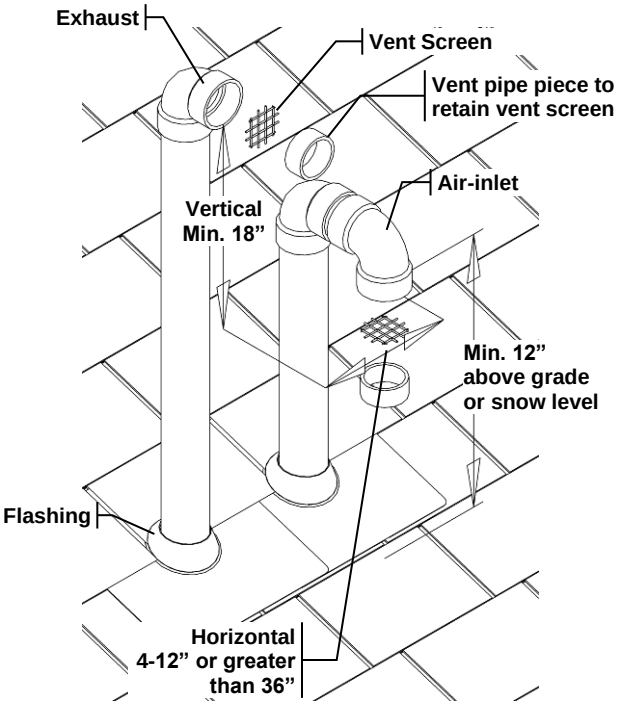



**Figure 4-10(b)**

**IPEX Concentric Termination (Roof)**

**⚠ WARNING**

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

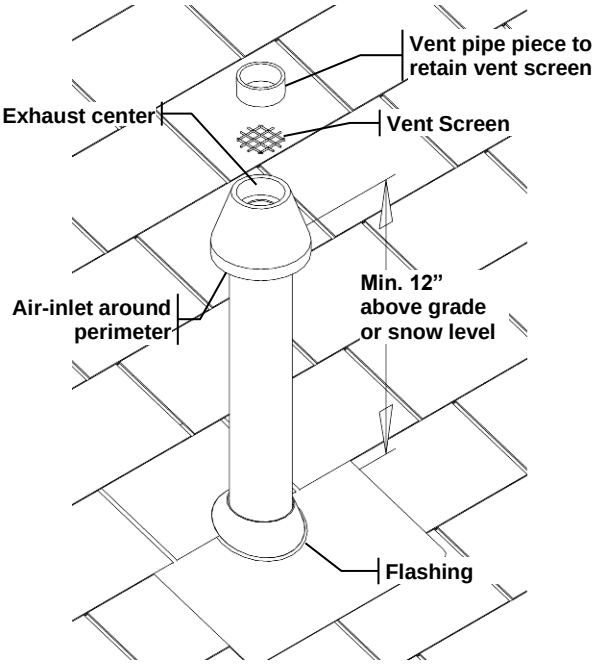



**Figure 4-10(c)**

**PolyPro / InnoFlue Termination (Roof)**

**⚠ WARNING**

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

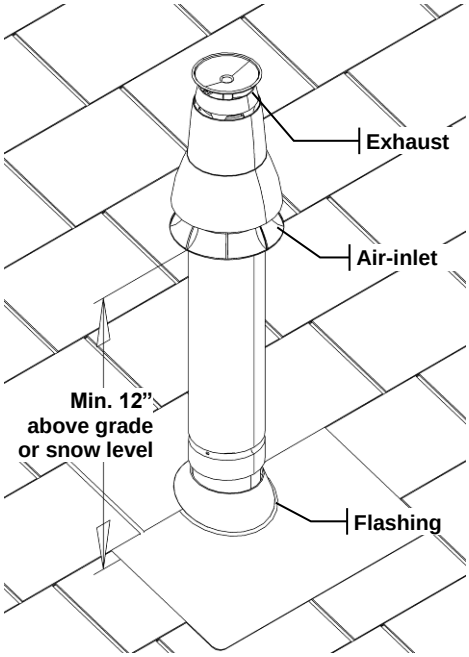
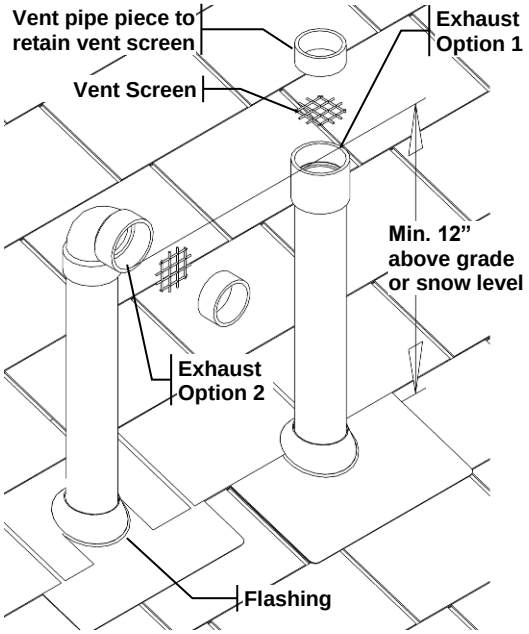



**Figure 4-10(d)**

**Exhaust only Termination (Roof)**

**⚠ WARNING**

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



### Instructions for Proper Venting Installation

1. **Follow Manufacturer's Instructions:** The venting system shall be installed in accordance with the appliance manufacturer's installation instructions and, if applicable, the venting manufacturer's installation instructions.
2. **Prevailing Winds:** Ensure the vent is located where it will not be exposed to normal prevailing winds.
3. **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.
4. **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.

   E*xample*: New Brunswick Canada - typical maximum snowfall is 19 in., thus the inlet must be (12 in. +19 in.) = 31 in. above grade and exhaust must be (31 in. +18 in.) = 49 in. above grade.
5. **Horizontal Separation:** The horizontal distance between the inlet and exhaust must be a minimum of 4 in. center to center.
6. **Wall Flashing:** Under normal operating conditions this water heater 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.
7. **Flue Gas Hazard:** Position the vent termination where vapors cannot make accidental contact with people and pets or damage nearby shrubs and plants.
8. **Elbow Extensions:** Elbows on outside of wall must be no more than ½ in. away from the wall.
9. **Vent Sloping:** All indoor exhaust piping must be on a slope back to the water heater a minimum of ¼ in. per linear foot of vent. For applications where excessive condensation is possible ½ in. per linear foot is recommended.
10. **Vent Supports:** Where required Vent and Air-inlet piping shall be secured to the wall for more rigidity. All interior horizontal vent pipe shall be supported a minimum of every 36 in.
11. **Roof Exhaust:** In all roof applications the discharge must point away from the pitch of the roof.
12. **Roof Flashing:** Install adequate flashing where the pipe enters the roof, to prevent water leakage.
13. **Rain Cap:** Install and seal a rain cap over existing chimney openings, in vacant chimney applications.
14. **Venting Below Grade:** For installations that exit the wall below grade refer to Figure 4-11.
15. **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.
16. **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.
17. **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.
18. **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.
19. **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.

**⚠ WARNING**

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

**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.

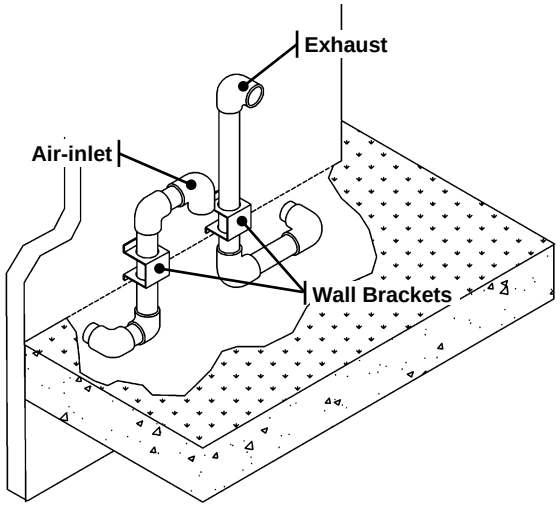



**Figure 4-12 Outdoor Venting**

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 water heater ½ in. elevation for every linear foot.

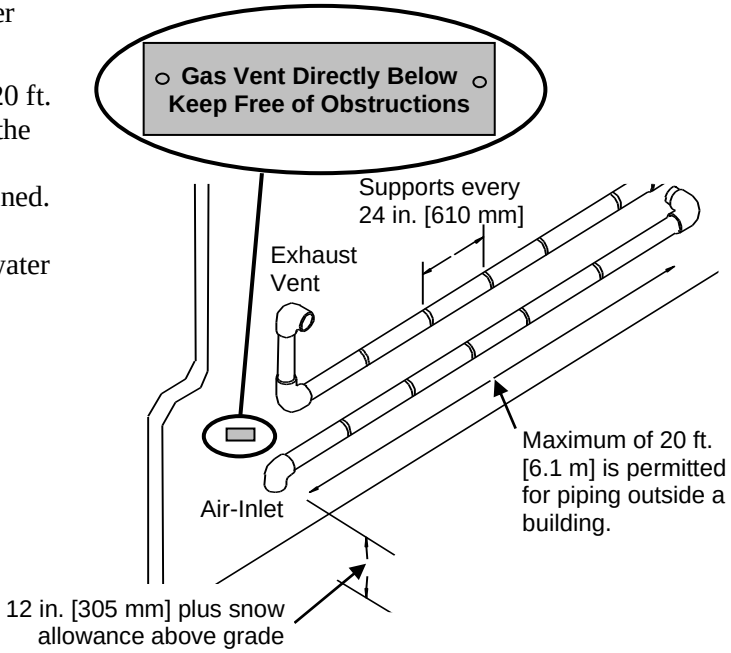
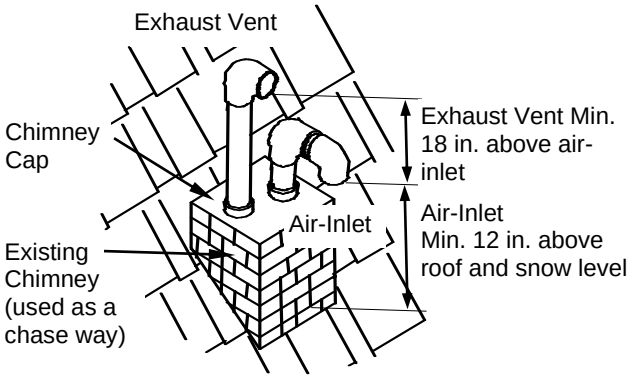



**Figure 4-13 Existing Chimney Chase Way**

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

1. The chimney is not being used by any other water heater.
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.




**⚠ DANGER** 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 lettered vent terminal clearances A through M illustrated in Figure 5-1 are described in Table 5-1; abide by these minimum vent terminal clearances while following the instructions detailed in Section 4.0 – General Venting. Failure to follow these instructions may result in fire, property damage, serious injury or death.

**NOTE**: Compliance alone doesn't ensure a satisfactory installation as good common sense must also be applied.

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

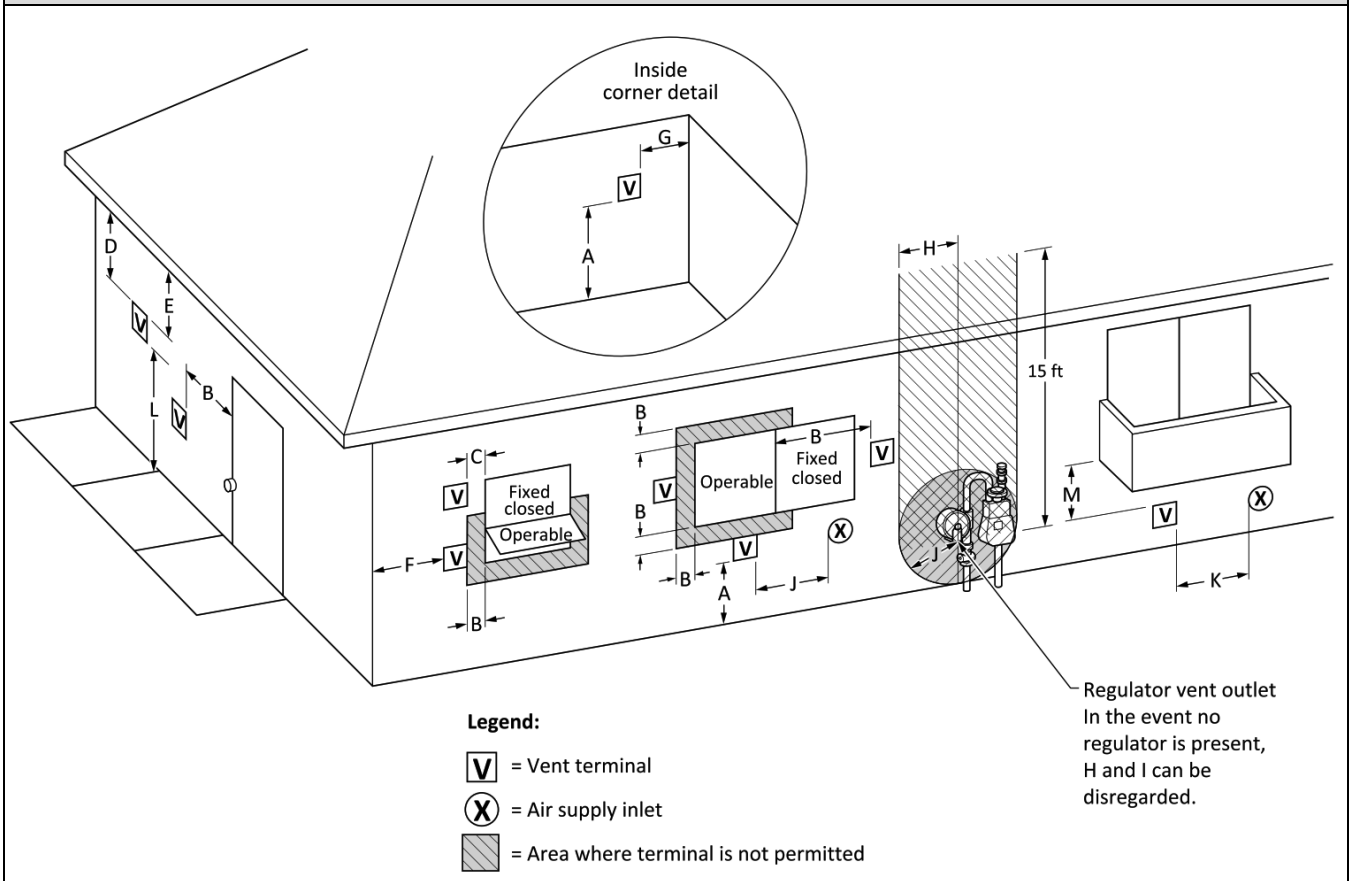



**Table 5-1 Vent Terminal Clearances (see Figure 5-1)**

| | | Canadian installations [1] | US installation [2] |
|---|---|---|---|
| A = | Clearance above grade, veranda, porch, deck, or balcony | 12 in (30 cm) | 12 in (30 cm) |
| B = | Clearance to window or door that may be opened | 36 in (91 cm) | Direct vent = 12 in (30 cm)<br>Other than direct vent = 4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening |
| C = | Clearance to permanently closed window | Not applicable | Not applicable |
| D = | Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal | 6 ft (1.83 m) | 6 ft (1.83 m) |

*(Continued)*

**Table 5-1 Concluded**

| | | **Canadian installations [1]** | **US installation [2]** |
|---|---|---|---|
| E = | Clearance to unventilated soffit | Not applicable | Not applicable |
| F = | Clearance to outside corner | Not applicable | Not applicable |
| G = | Clearance to inside corner | 36 in (91 cm) | 36 in (91 cm) |
| H = | Clearance to each side of center line extended above meter/regulator assembly | 3 ft (91 cm) within a height 15 ft (4.6 m) | 3 ft (91 cm) within a height 15 ft (4.6 m) |
| I = | Clearance to service regulator vent outlet | 3 ft (91 cm) | 3 ft (91 cm) |
| J = | Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance | 36 in (91 cm) | Direct vent = 12 in (30 cm)<br>Other than direct vent = 4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening |
| K = | Clearance to a mechanical air supply inlet | 6 ft (1.83 m) | 3 ft (91 cm) above if within 10 ft (3 m) horizontally |
| L = | Clearance above paved sidewalk or paved driveway located on public property | Vents cannot be located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard | Vents cannot be located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard |
| M = | Clearance under veranda, porch deck, or balcony | 12 in (30 cm) [4] | 12 in (30 cm) [4] |

**Notes**:

1) *In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code.*
2) *In accordance with the current Z223.1/NFPA 54, National Fuel Gas Code.*
3) *If locally adopted installation codes specify clearances different than those illustrated, then the most stringent clearance shall prevail.*
4) *Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.*

## 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 water heater 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):

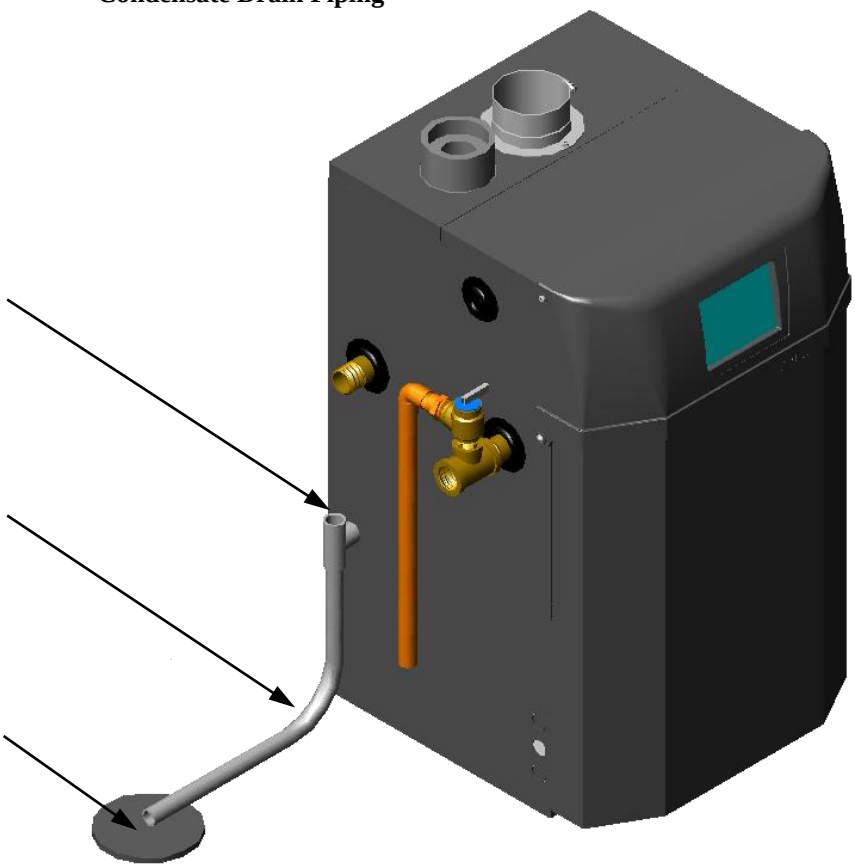
- **DO NOT** install condensate lines outside. A frozen or blocked drain will cause the condensate to fill the combustion chamber. This will result in a no heat condition, as the unit will shut down, and damage to the flame sensor, and components can occur.
- **NEVER** use copper, steel, or galvanized 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 water heater 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**
**C**onnection 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

**⚠ DANGER**

Trinity Lx Water Heaters are factory set to operate with Natural Gas; **BEFORE OPERATING WITH PROPANE**, the boiler must be converted using the appropriate *Natural to LP Conversion Kit*; see Table 7-1. Failure to properly convert the unit to safely operate with Propane will cause dangerous burner operation, resulting in property damage, serious injury or death.

**⚠ WARNING**

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

**Table 7-1 Natural Gas to LP Propane Conversion Kit**

| Model Number | LP Conversion Kit Number | LP Orifice |
|---|---|---|
| Lx200WH | 82650-1 | 52 (5.2 mm) |
| Lx300WH | 82650-1 | 62 (6.2 mm) |
| Lx400WH | 83017-1 | 62 (6.2 mm) |
| Lx500WH | 84386-1 | No Orifice [1] |

**Notes:**

[1] No LP orifice is used with model Lx500WH, see conversion kit instructions for information on adjusting the throttle screw convert water heater to LP.

[2] Models Lx600WH-Lx800WH 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 water heater does not apply any weight to the gas valve. NTI recommends using approved flexible gas piping (if acceptable by local codes) to connect the water heater 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 water heater 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 water heater 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 water heater, are checked for leaks using a "Bubble Test", prior to operating the water heater.

**⚠ 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.

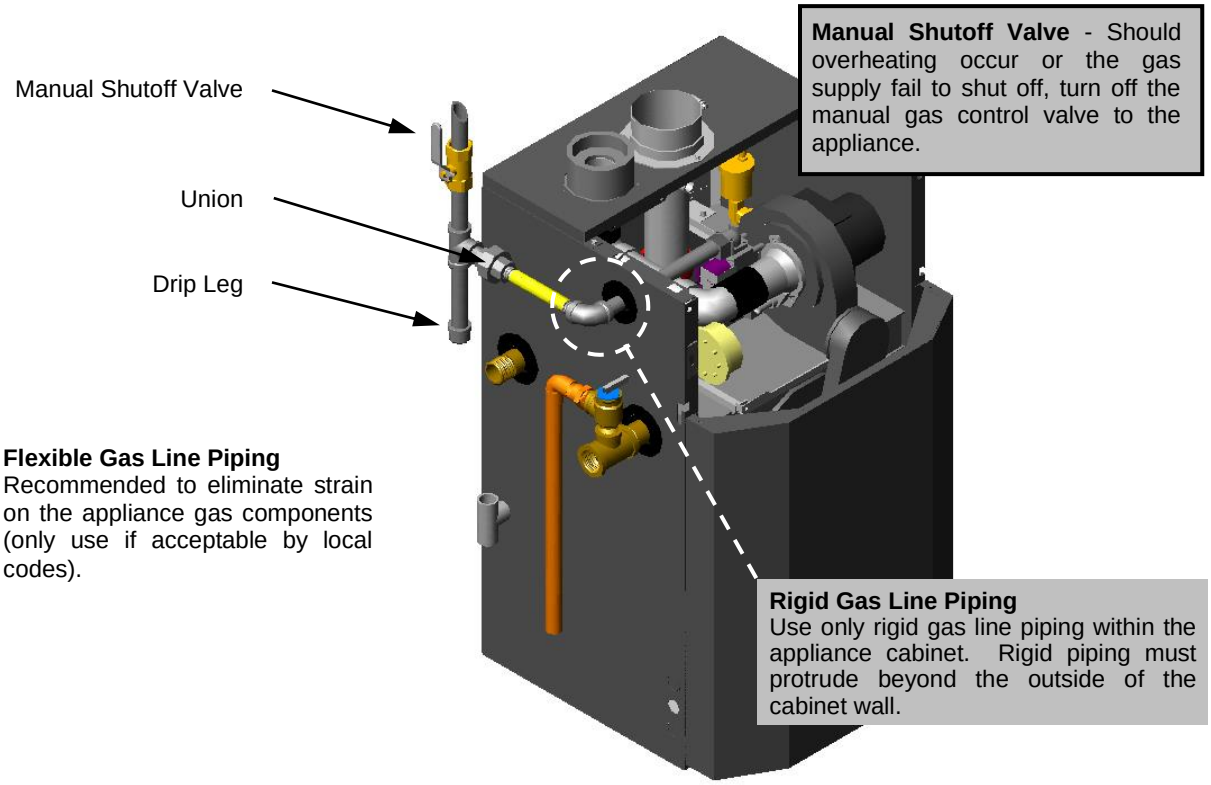
**⚠ WARNING** Flexible gas piping cannot be used within the water heater cabinet and cannot pass through the cabinet wall, use rigid piping as shown in Figure 7-1. Failure to follow these instructions may result in fire, property damage, serious injury or death.

**⚠ 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 water heater 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 Lx200WH Illustrated**



## 8.0 LIGHTING THE WATER HEATER

**⚠ 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 water heater, 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 water heater. Failure to follow instructions could result in explosion causing property damage, serious injury or death.

### FOR YOUR SAFETY, READ BEFORE OPERATING

A) This water heater 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 water heater 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 water heater.
- 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 water heater if any part has been under water. Immediately call a qualified service technician to inspect the water heater 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 water heater.
3. This water heater 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 water heater.
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 Water heater” and call your service technician or gas supplier.

### TO TURN OFF GAS TO THE WATER HEATER

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

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

- Ensure the water heater 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 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 water heater 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 then 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 water heater 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 water heater.
3. This water heater 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 water heater.
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 water heater" and contact a professional service technician, or gas supplier.

### Turning Off the Water heater

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

## 9.0 GAS VALVE AND BURNER SET-UP

**⚠ WARNING** 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.

### Combustion Calibration Procedure

To calibrate burner combustion, perform the following procedure using a calibrated combustion analyzer capable of measuring $CO_2$ and CO from a Natural Gas or Propane burning appliance:

1. **Set analyzer** to the appropriate fuel (Natural Gas or Propane).
2. **Gas Line Pressure Test** – monitor gas line pressure throughout all combustion tests and verify it is maintained within tolerance. See *Gas Line Pressure Test* below.
3. **Set Throttle Screw** – operate burner to the maximum modulation rate (see Table 9-2); set combustion according to Table 9-1 using the Throttle Screw; allow time for the analyzer readings to stabilize between adjustments – record $CO_2$ value. See *Throttle Screw Adjustment* below.
4. **Set Offset Screw** – operate burner to the minimum modulation rate (see Table 9-2); using the Offset Screw, set the $CO_2$ to 0-0.5% lower than the value obtained during the maximum modulation rate test (e.g., if $CO_2$ at Max = 9.0%, then $CO_2$ at Min must = 8.5-9.0%). See *Offset Screw Adjustment* below.

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

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

### Throttle Screw Adjustment

The gas valve Throttle Screw (see Figures 9-1 to 9-4) is used to calibrate the $CO_2$ concentration with the burner operating at or near the maximum modulation rate (see Table 9-2). Turning the Throttle Screw in (clockwise) decreases the $CO_2$ concentration. Turning the Throttle Screw out (counterclockwise) increases the $CO_2$ concentration. Typical adjustment required is $0 - {}^{1}/_{2}$ of a turn in or out from the factory setting.

**NOTE:** Calibration of the Throttle Screw should only be performed with the burner operating at or near the maximum modulation rate (see Table 9-2).

**⚠ WARNING** Adjustments to the **Throttle Screw** may only be made by a qualified gas technician using a calibrated combustion analyzer capable of measuring $CO_2$ and CO. Adjustments may only be performed if the gas line pressure is maintained above minimum levels throughout the duration of the test (see Table 9-1). Failure to follow these instructions may result in serious injury or death.

### Offset Screw Adjustment

The gas valve Offset Screw (see Figures 9-1 to 9-4) is used to calibrate the $CO_2$ offset at minimum modulation vs. maximum modulation. Turning the Offset Screw in (clockwise) increases the $CO_2$ concentration at minimum modulation rate. Turning the Offset Screw out (counterclockwise) decreases the $CO_2$ concentration at minimum modulation rate. Typical adjustment required is $0 - {}^{1}/_{8}{}^{th}$ of a turn in or out from the factory setting.

**NOTE:** Calibration of the Offset Screw must only be performed with the burner operating at the minimum modulation rate (see Table 9-2).

**⚠ WARNING** Adjustments to the Offset Screw may only be made by a qualified gas technician using a calibrated combustion analyzer capable of measuring $CO_2$ and CO, and only with the burner at the minimum modulation rate (see Table 9-2). Attempting to set the Offset Screw while the burner is operating at a modulation rate other than the minimum will result in incorrect combustion and may lead to burner damage or excessive CO.

## Gas Line Pressure Test

The water heater 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 water heater to ensure if falls within the range given in Table 9-1:

1. Turn the supply of gas to the water heater off.
2. Open the bleed screw of the line pressure test port approximately 1-1/2 turns (Lx200WH-Lx500WH models). This port is directly connected to the gas line feeding the water heater. For Lx600WH-Lx800WH 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 9-4.
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 water heater 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 Lx600WH-Lx800WH models, replace the installed hose barb fitting with the factory 1/8" NPT plug; use NG/LP approved thread sealant.

**NOTICE**

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

**⚠ DANGER**

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

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

| Gas | Line Pressure (inches w.c.) | | | $CO_2$ (%) [1] | | CO (ppm) Max. |
|---|---|---|---|---|---|---|
| | Nominal/Desired | Min. | Max. | Min. | Max. | |
| **Natural** | 7 | 4 [2] | 10.5 | 8.5 | 9.5 | 175 |
| **Propane** | 11 | 8 | 13 | 9.5 | 10.5 | 175 |

**Notes:**
[1] Combustion calibration must only be performed with the burner operating at maximum modulation rate; when tested at minimum modulation rate the $CO_2$ must be 0-0.5% lower than $CO_2$ at maximum modulation rate.
[2] The minimum permissible line pressure when operating with Natural Gas is 5.5 inches w.c. for model Lx500WH.

**Table 9-2 Minimum and Maximum Modulation Rates**

| Modulation Rate (rpm) | Lx200WH | Lx300WH | Lx400WH | Lx500WH | Lx600WH | Lx700WH | Lx800WH |
|---|---|---|---|---|---|---|---|
| **Minimum** | 925 | 1250 | 1550 | 1400 | 1050 | 1250 | 1250 |
| **Maximum** | 5950 | 5850 | 7250 | 6400 | 4350 | 4300 | 5300 |

**Note:** use *Diagnostic Test*, accessed from the *Diagnostic* menu of the display, to force max. and min. modulation rates; see Appendix A – Controller and Touchscreen Display Instructions, Section 5 DIAGNOSTICS PAGE.

**Figure 9-1 Gas Valve and Venturi Assembly (Lx200WH & Lx300WH)**

**Lx200WH Orientation Illustrated**

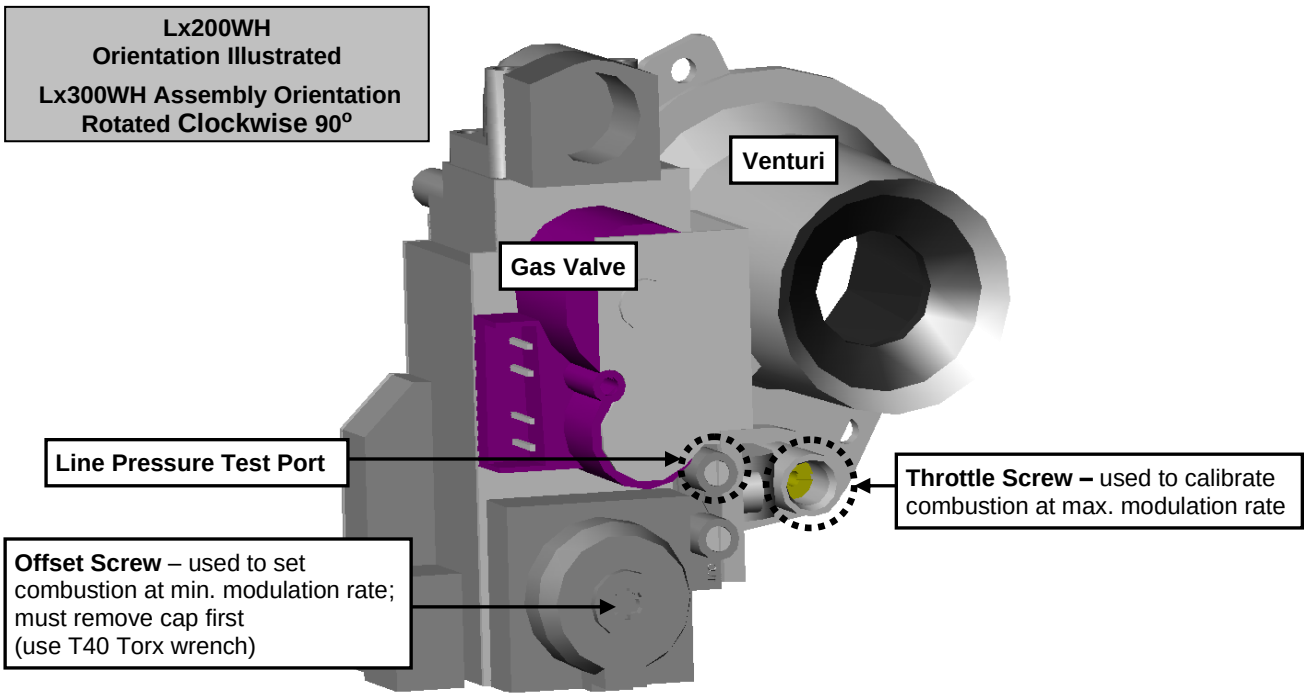



**Figure 9-2 Gas Valve and Venturi Assembly (Lx400WH)**

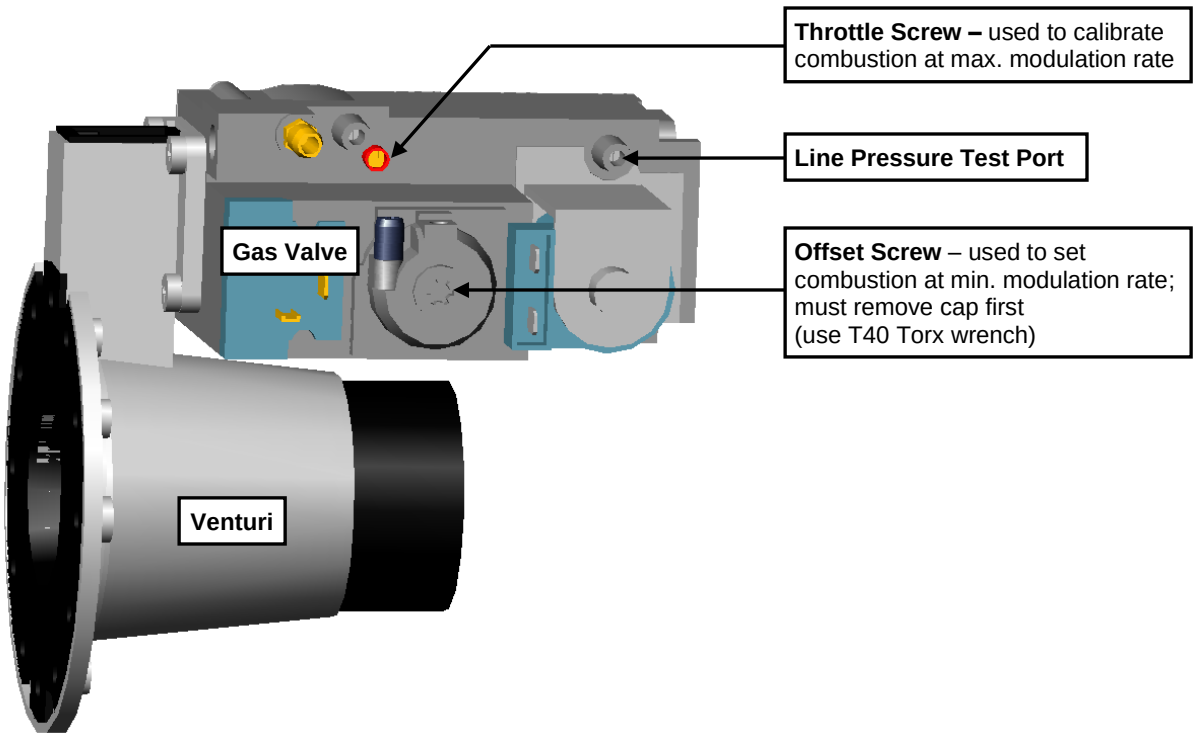


**Figure 9-3 Gas Valve Assembly (Lx500WH)**

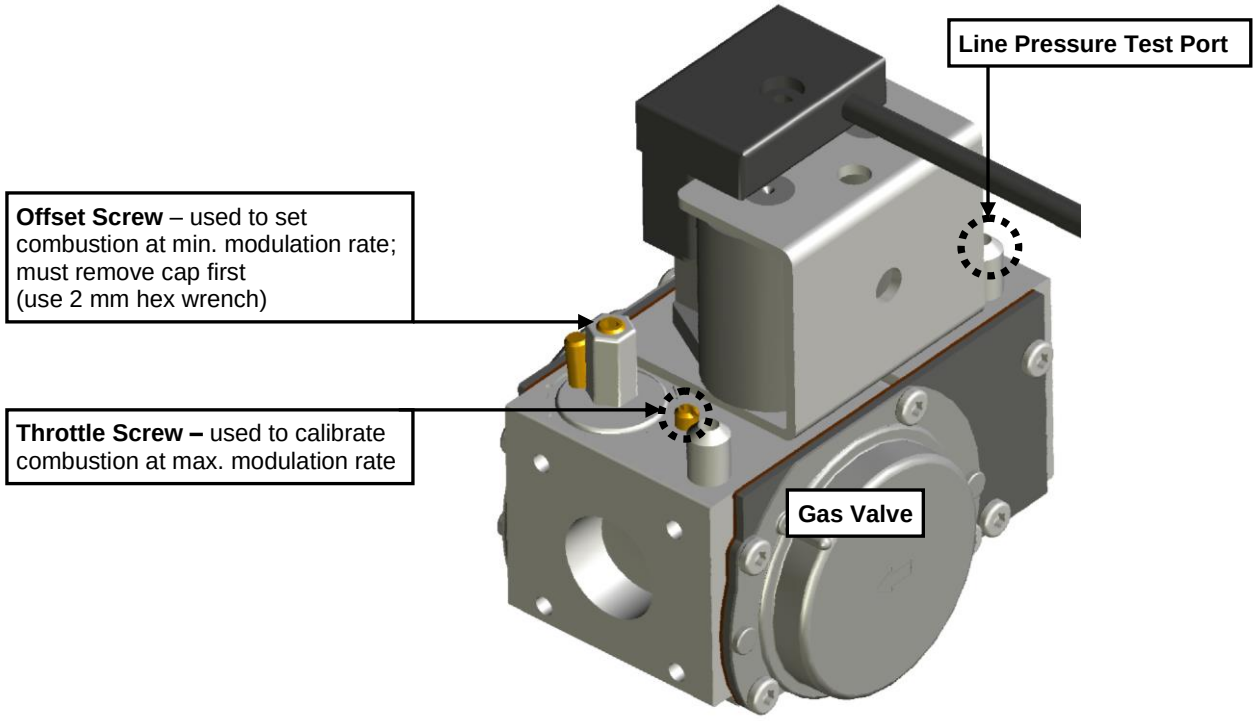
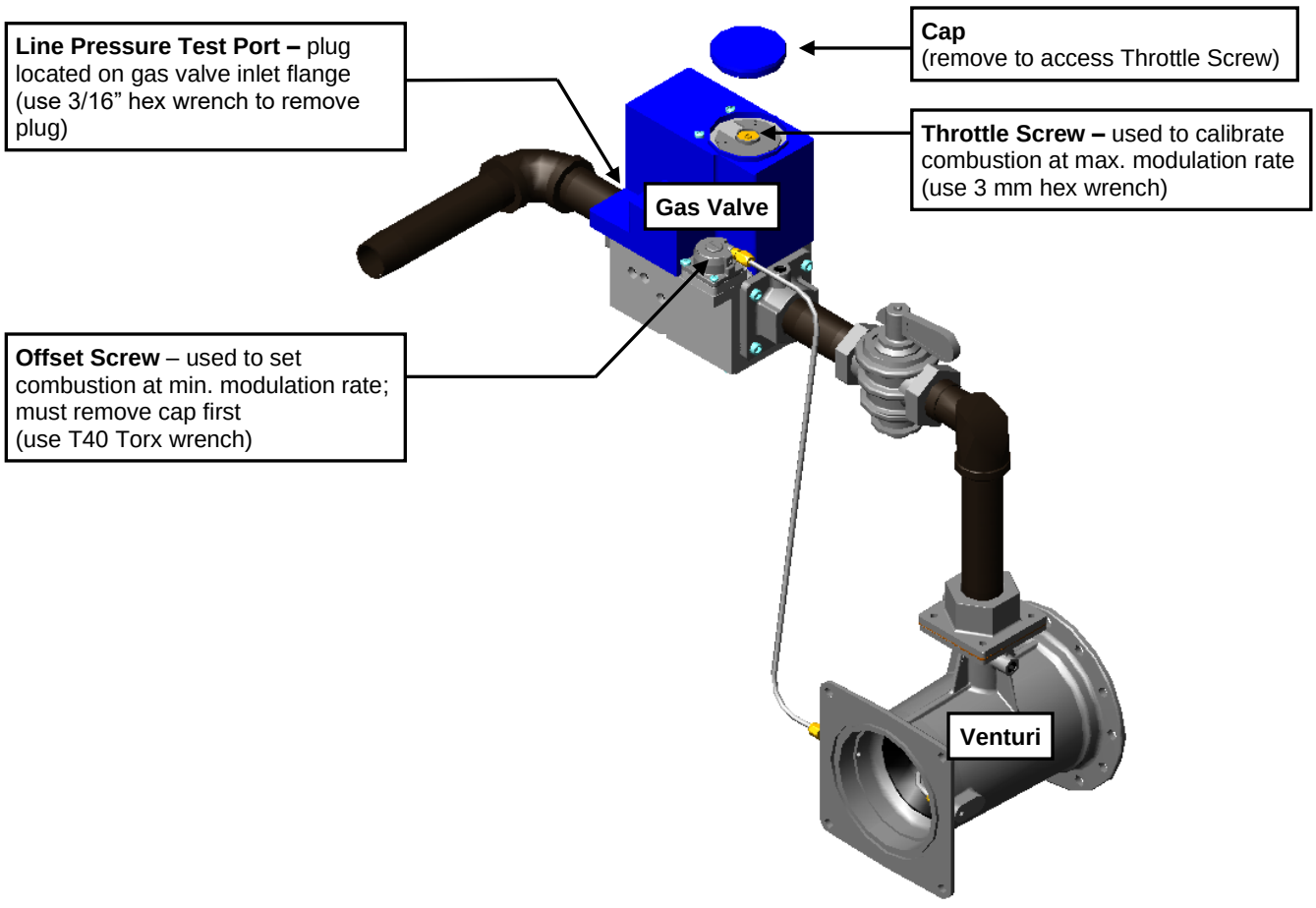



**Figure 9-4 Gas Valve and Venturi Assembly (Lx600WH-Lx800WH)**



## 10.0 WATER HEATER PIPING

The heat exchanger of the Trinity water heater 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.

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

### Water Heater System Preparation

Prior to connecting plumbing to the water heater, 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 water heater. During the assembly of the piping system, it is important to keep the inside of the piping free of any debris including construction and copper dust, sand, and dirt. Toxic chemicals, such as used for boiler treatment, shall not be introduced into the potable water system.

**Water Chemistry** – The installer of the Trinity Lx water heater must consider the condition of the potable water. Ensure the water condition falls within the following recommended parameters to avoid scale build-up and aggressive PH levels that can result in corrosive reactions and damage to the heat exchanger and system components:

- Conductivity – 170 to 400 µS/cm (at 25ºC); [TDS 80 to 200 ppm or Total Hardness 5 to 12 grains/USgal.]

***NOTICE*** Water heater water that falls outside of the parameters listed above must only be conditioned or treated with products approved for potable hot water systems. Toxic chemicals, such as used for boiler treatment must not be introduced into the potable water system.

### Potable Water Systems

This water heater is suitable for water (potable) heating and space heating. The water heater can be configured for "water (potable) heating only" or "combination space heating" and is subject to the following requirements:

1) Piping and components connected to the water heater for use with water (potable) heating or combination space heating applications shall be suitable for use with potable water.
2) Toxic chemicals, such as used for boiler treatment, shall not be introduced into the potable water system.
3) This water heater which will be used to supply potable water shall not be connected to any heating system or component(s) previously used with a non-potable water heating appliance.
4) When the system requires water for space heating at temperatures higher than required for other uses, a means such as a mixing valve shall be installed to temper the water for those uses to reduce scald hazard potential.

### Definitions of Potable Water Systems

Each potable water system described below is meant to be used with a storage tank (refer to Table 10-1):

- **Water (Potable) Heating Only** - refers to an open potable water system dedicated to providing domestic hot water and is not intended for space heating.
- **Combination Space Heating** - refers to an open potable water system where the domestic hot water and heating system water are drawn from the same storage tank. Heat exchange typically takes place in the water heater and there is no separation or differentiation between water used for domestic hot water and water used for space heating.
- **Storage Tank (Vessel)** - refers to a tank used to store hot water that is heated indirectly by a water heater external to the tank or a container provided for storage of hot water under pressure.

**⚠ WARNING** **Combination Space Heating** - A boiler with indirect fired water heater is the preferred method for combination space heating; therefore, the building owner assumes all risk and responsibility with respect to installation, maintenance, and operation of this water heater in a combination space heating application. Failure to follow instructions may result in possible illness or death.

### Safe Temperatures for Potable Water

Two factors used to determine safe hot water temperatures are Legionella and scalding. Potable water needs to be stored at temperatures hot enough to limit the growth of Legionella yet be cool enough to prevent scalding. Since both hazards present a potential risk to the user, they must be monitored and controlled. Table 10-1 indicates how water temperature affects Legionella bacteria and contributes to scald injury. Use of a thermostatic mixing valve in the water heater plumbing system can help protect against both hazards. By storing potable water at higher temperatures, bacteria growth is controlled, while still providing high temperature water for dishwasher applications and low temperature water for bathing. Before proceeding, read the following carefully and take all necessary pre-cautions to avoid potential illness and/or injury that can result from Legionella or scalding hazards.




**Legionella Hazard** - This bacterium is naturally occurring in surface water and ponds. It can also be found in man-made water systems around the world such as water storage tanks, water distribution systems, fountains, hot tubs, humidification systems, refrigeration systems and grocery produce misters. Health authorities agree that Legionella bacteria most often enter the lungs due to aspiration when contaminated water spray is breathed in as opposed to ingesting drinking water contaminated with the bacteria. Typical illnesses attributed to Legionella include flue like symptoms (Pontiac Fever) and a potentially fatal type of pneumonia (Legionnaires' disease). Failure to follow instructions may result in illness or death.



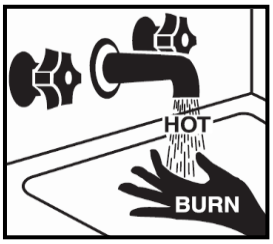

**High Risk Application** - Combination space heating systems can present a significantly higher risk of developing Legionella than dedicated domestic hot water systems, especially during non-heating seasons or low temperature water applications. Using higher temperature tank water, routinely maintaining your water system, and having your water tested annually are considered "good practice" when it comes to controlling conditions that contribute to Legionella. See Table 10-1. Failure to monitor and maintain your combination space heating system may result in illness or death.

**Contributing Factors to Legionella** - Experts acknowledge that Legionella is an identified risk in most water systems. Although eradicating Legionella is improbable, pre-cautions can be taken to control and monitor conditions that promote bacteria growth. According to the World Health Organization (WHO); American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE); Canada Safety Council (CSC); and Centers for Disease Control (CDC), contributing factors to the growth of Legionella in potable water systems include:

- Minerals and nutrients present in the source water and systems materials
- Stagnation or low flow characteristic of dead ends in distribution piping systems and storage tanks
- Scale, corrosion, and bio film
- Tepid water in cold water lines
- Water storage temperatures optimal for bacteria growth
- Chlorine concentration




**Scald Hazard** - Hotter water increases the risk of scald injury. There is a hot water scald potential if the storage tank thermostat is set too high. Before changing the temperature setting on the tank thermostat, refer to the thermostat manufacturers recommended settings. Failure to follow these instructions may result in serious injury or death.




A scald injury can occur when hot steam or liquid makes contact with one or more layers of skin. Scald severity (degree of burn) is directly impacted by exposure time and temperature. Refer to Table 10-1. The following basic precautions are common sense:

- Young children and elderly adults burn more quickly and should use cooler water.
- Never leave a child alone while drawing water in a bathtub.
- Test the water temperature before bathing or showering.
- Turn cold water on first, then add hot water until the temperature is comfortable.

⚠ WARNING

**Thermostatic Mixing Valve** - When the system requires water at temperatures higher than required for other uses, such as high temperature applications typically greater than 46ºC (115ºF), a means such as a thermostatic mixing valve shall be installed to temper the water for those uses to reduce scald hazard potential. Anti-scald devices such as a thermostatic mixing valve allows potable water to be stored at a higher temperature to limit bacteria growth and allows water at the tap to be delivered at a lower temperature to prevent scalds. Failure to follow these instructions may result in serious injury or death.

⚠ CAUTION

Water stored at temperatures between 68-113ºF is ideal for bacteria growth (see Table 10-1); therefore, consuming water from a Water Heater is not recommended. Consuming water from a Water Heater may cause illness or death.

IMPORTANT

**Legislation and Guidelines** - At the time this document was written, standards and guidelines regulating the prevention of Legionella in the United States and Canada were mostly voluntary. The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) is currently in the process of converting its guideline entitled "Minimizing the Risk of Legionellosis Associated with Building Water Systems" (ASHRAE Guideline 12-2000) into an official standard. Consult with your local authorities as to recommended guidelines for controlling Legionella in potable water systems.

**General Guidelines** - In the absence of a National standard or local codes, the following are general guidelines for "good practice" on maintaining, monitoring and operating your potable water system:

- Store hot water at temperatures $\geq$ 60ºC (140ºF) for "water (potable) heating only" applications.
- Store hot water at temperatures $\geq$ 80ºC (176ºF) for "combined space heating" applications.
- Store and distribute cold water at temperatures below 20ºC (68ºF).
- System supply for uses other than high temperature applications typically greater than 46ºC (115ºF) shall be equipped with a thermostatic mixing valve on the hot water outlet to reduce potential scald hazards.
- Clean aerators and nozzles on water fixtures on a regular basis to reduce scale build-up.
- Clean storage tanks and remove sediment. Flush storage tanks and piping systems regularly for 10-30 minutes at high water temperatures (depending on guidelines used) to rid the system of sediment and scale that develops, typically in the bottom of storage tanks where water temperature is coolest, and piping runs where water can stagnate.
- Abandoned water lines should be capped off at the distribution main, not at the most convenient place.
- Avoid dead-ends in piping system. If unavoidable, provide a drainage port in these areas at the lowest point to flush out stagnant water regularity.
- Insulate DHW recirculation lines and keep pipe runs as short as possible.
- Recommend annual water testing of water in your tank and piping system(s) to monitor water conditions.
- Keep a maintenance record of when your water heater and storage tank were cleaned, piping systems flushed and who did the service work.

**Table 10-1 How Water Temperature relates to Legionella and Scald Hazard**

| Water Temperature [1] | | Legionella Bacteria [1] | Water Temperature [2,5] | | Exposure Time vs Burn [5] |
|---|---|---|---|---|---|
| 158-176ºF | 70-80ºC | Disinfection range | 158ºF | 70ºC | 1 second - 2nd or 3rd degree burn |
| 140-149ºF | 60-65ºC | Bacteria die within minutes | 140ºF | 60ºC | 5 seconds - 2nd or 3rd degree burn |
| 122-131ºF | 50-55ºC | Bacteria die within hours | 131ºF | 55ºC | 5 seconds - 1st degree burn |
| 68-113ºF | 20-45ºC | Bacteria thrive and multiply | 122ºF | 50ºC | 1 minute - 1st degree burn |
| below 68ºF | below 20ºC | Bacteria is dormant | 111ºF | 44ºC | 5 hours - 1st degree burn [3,4] |

**Notes:**
[1] Published by Chartered Institute of Plumbing and Heating Engineering, Databyte series, "Safe Hot Water Temperatures".
[2] The elderly and small children are susceptible to bad burns at shorter exposure times than listed in this table.
[3] A thermostatic mixing valve should be installed on DHW storage tanks when outlet temperatures exceed 115ºF [46ºC].
[4] Typical water temperature for bathing or showering range between 98-113ºF [37-45ºC].
[5] Temperature-Time-Burn Chart published by John Hopkins University, excluding notes.

## Near Water Heater Plumbing

**Pressure Relief Valve -** A Pressure Relief Valve is factory supplied with each unit and must be field installed at the water heater outlet in the vertical position, as shown in Figures 10-1(a) and (b), with the drainpipe outlet exiting the side of the pressure relief valve horizontally and elbowing down. Lx200WH-Lx400WH models come with a 125-psi relief valve, while Lx500WH-Lx800WH models come with a 150-psi relief valve. The maximum allowable working pressure (MAWP) varies with water heater 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 water heater.

⚠ 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 water heater 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**

| Water heater Model | Maximum Pressure Relief Valve Setting / Water heater MAWP (psi) | Minimum Pressure Relief Valve Capacity (MBH) |
|---|---|---|
| Lx200WH | 145 | 200 |
| Lx300WH | 160 | 300 |
| Lx400WH | 145 | 400 |
| Lx500WH | 160 | 500 |
| Lx600WH | 160 | 600 |
| Lx700WH | 160 | 700 |
| Lx800WH | 160 | 800 |

**Figure 10-1(a) Near Water Heater Piping (Lx200WH-Lx400WH)**

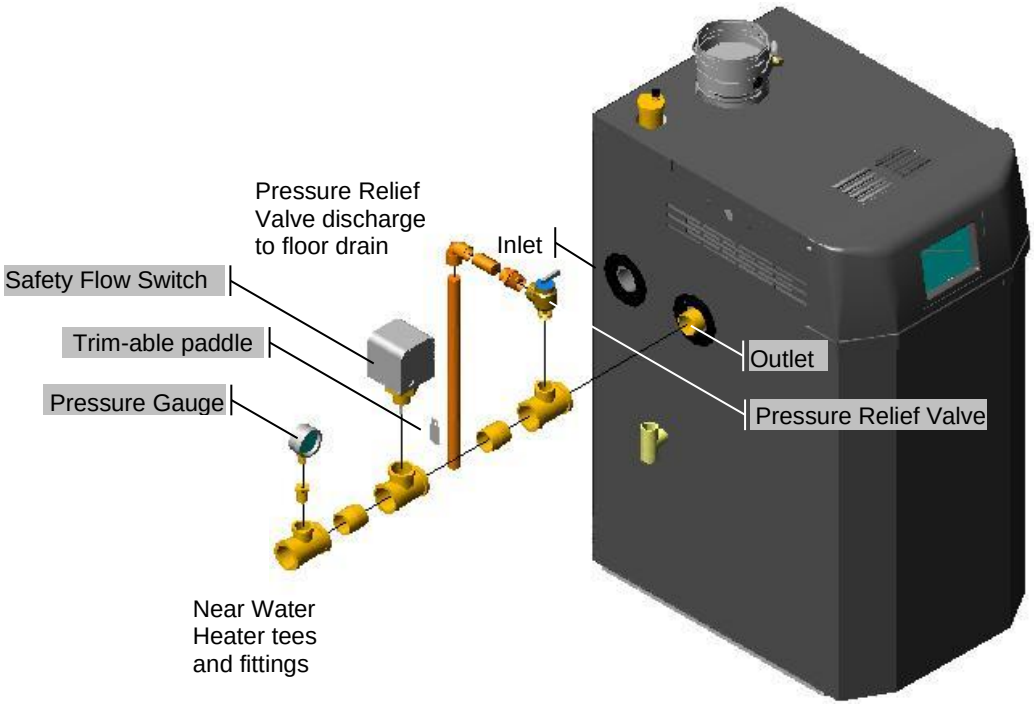
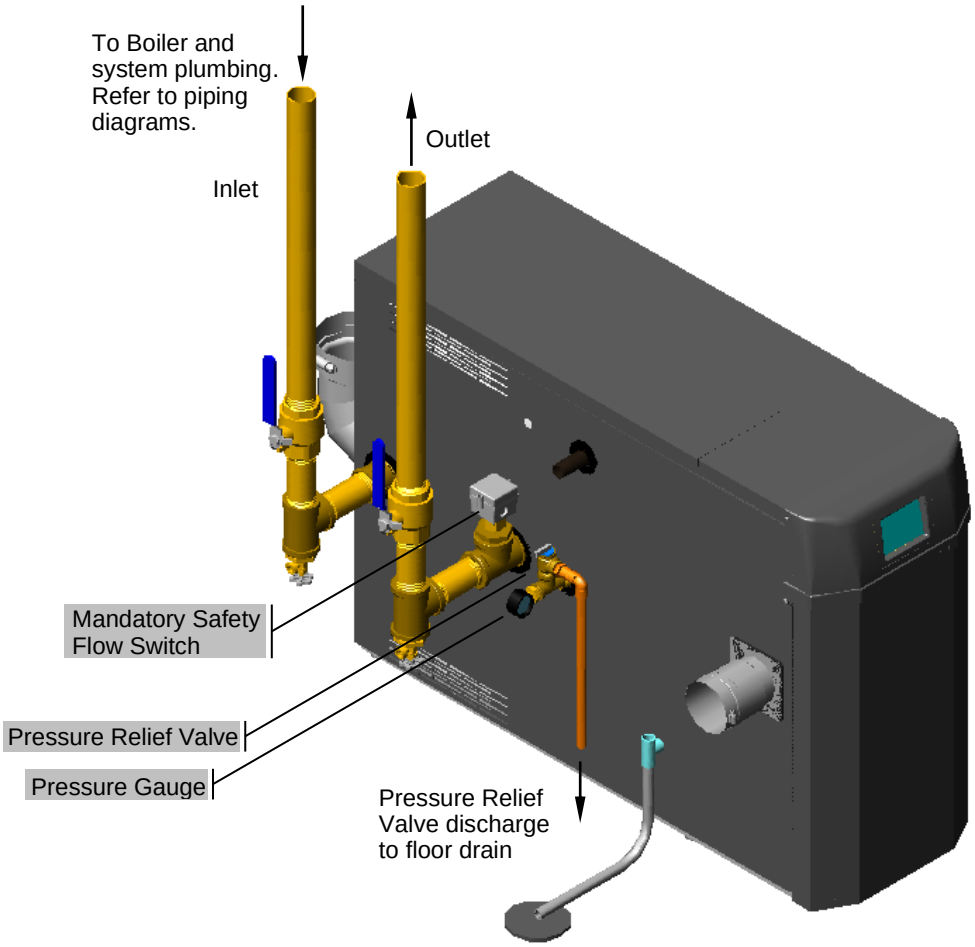



**Figure 10-1(b) Near Water heater Piping (Lx500WH-Lx800WH)**



**Safety Flow Switch** - A safety flow switch is required by code to ensure a sufficient rate of water supply is available for proper operation of the water heater. NTI models Lx500WH-Lx800WH come factory equipped with a safety flow switch installed; for models Lx200WH-Lx400WH, a safety flow switch must be field supplied and installed. Locate the flow switch in series with the water heater and in accordance with the instructions provided with the safety flow switch. NTI recommends a safety flow switch with an activation point no lower than the flow rate specified in Table 10-3.

**Table 10-3 Flow Switch Installation Requirements**

| Model | Activation Point (no lower than) | Line Size for Flow Switch |
|---|---|---|
| Lx200WH | 6 gpm | 1 |
| Lx300WH | 9 gpm | 1-1/4" |
| Lx400WH | 12 gpm | 1-1/4" |

**IMPORTANT: After the flow switch, increase pipe diameter to the size specified in Table 10-5. Refer to Section 12.0 for instructions on wiring the safety flow switch.**

**NOTICE**

The Safety Flow Switch must be installed on the water heater 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 model Lx200WH, and a 1-1/4" diameter line for models Lx300WH & Lx400WH.

**NOTICE**

Models Lx500WH-Lx800WH 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.

**NOTICE**

The Safety Flow Switch must be wired as per the instructions provided in this manual. Refer to Section 12.0 for wiring instructions.

## Water Heater System Plumbing

The Trinity water heater uses a low mass heat exchanger that requires a minimum rate of forced water circulation any time the burner is operating (See Table 10-5 for minimum flow rates). To ensure the minimum flow rate is attained, the water heater must be installed with a safety flow switch (see Figure 10-2 for suggested plumbing diagram). A properly installed system will as a minimum include the major components in Table 10-4.

**Table 10-4 System Major Component Checklist**

| Factory Supplied Components | Field Supplied Components |
|---|---|
| ☐ Pressure Relief Valve [1] | ☐ Bronze/Stainless Steel Water Heater Circulator (Pump B in Figure 10-2) |
| ☐ Pressure Gauge (160PSI) | ☐ System Backflow Preventer (check if required by local codes) [2] |
| ☐ Flow Switch (Lx500-800 only) | ☐ DHW/Potable Water Expansion Tank (check if required by local codes) [2] |
| | ☐ DHW Storage Tank |
| | ☐ Tank Temperature and Pressure Relief Valve |
| | ☐ Tank Thermostat (aquastat) |
| | ☐ Thermostatic (Anti-Scald) Mixing Valve |
| | ☐ Safety Flow Switch |

**Notes:**

1 Refer to Table 10-2 for minimum Pressure Relief Valve specifications.

2 Expansion Tank is mandatory if using a System Backflow preventer

**Water Heater Circulator** - The Lx water heater is equipped with three 120VAC pump outputs (Pump A, B and C). Use only Pump Output B for the Water Heater Circulator. Note that bronze or stainless-steel circulators are required for potable water systems. Ensure that circulators (pumps) are oriented as per the pump manufacturers' instructions. See Section 12.0 for wiring details.

**NOTICE**

Circulators responsible for forcing the water flow rate through the water heater must be sized according to Table 10-5, see Figure 10-2 for details.

**⚠ WARNING**

Failure to ensure the minimum water flow rate through the water heater when the burner is on will not only reduce the operating efficiency of the water heater, 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 10-5 Minimum Water Heater Circulator and Pipe Sizes**

| Model | Restriction Head Loss | Min. Pipe Size | Min. Flow (GPM) | Max. Temp. Rise | Maximum Current Load | Minimum Pump Size [1] | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B&G | Grundfos | Armstrong | Taco |
| 200 | 16' at 16 GPM | 1-1/4" | 16 | 23°F | 5 A or 2/5 hp | PL-36B | UP 26-99 | E8.2B | 0013-MSSF |
| 300 | 16' at 24 GPM | 1-1/2" | 24 | 23°F | 5 A or 2/5 hp | PL-36B | UPS 26-150 | E14.2B/E9.2B [3] | 2400-30S [3] |
| 400 | 20' at 32 GPM | 2" | 32 | 23°F | 5 A or 2/5 hp | PL-55B | UPS 26-150 | E24.2B | 2400-50S |
| 500 | 25' at 40 GPM | 2" | 40 | 23°F | See Note [2] | PDB-37 | TP 32-160 | E22.2B[5] | 1935B |
| 600 | 23' at 48 GPM | 2-1/2" | 48 | 23°F | See Note [2] | PDB-37 | TP 32-160 | E22.2B[5] | 1935B |
| 700 | 19' at 56 GPM | 2-1/2" | 56 | 23°F | See Note [2] | PDB-37 | TP 32-160 | E33.2B[6] | 1935B |
| 800 | 25' at 64 GPM | 2-1/2" | 64 | 23°F | See Note [2] | PDB-38 | UPS 40-160 | - | 1935B |

**Notes:**
1. Pump models listed are for bronze or stainless-steel circulators only; cast iron pumps are not permitted.
2. Maximum Current Load 1-1/2hp @ 120VAC or 3hp @ 240VAC.
3. Armstrong pumps E10.2B-E13.2B, and Taco pump 2400-30S are not recommended.
4. Armstrong pump E15B-17B not recommended.
5. Armstrong pump E23.2B-E33.2B not recommended.
6. Armstrong pumps E22.2B and E24.2B also recommended.

**System Backflow Preventer** - Check if a backflow preventer is required by local codes. This manufacturer and most plumbing codes require a thermal expansion control device be installed if a backflow preventer, pressure reducing valve or check valve is installed on a domestic supply line. Installing an expansion tank approved for use with potable water is mandatory in applications using a System Backflow Preventer device.

**DHW/Potable Water Expansion Tank** - Check if an expansion tank is required by local codes. If required, the expansion tank must be suitable for use with potable water and be sized in accordance with the water volume of the system as well as the firing rate of the appliance. The expansion tank must be installed downstream of any backflow prevention device used to control system thermal expansion. See example in Figure 10-2.

**⚠ CAUTION**

Ensure the expansion tank cannot become isolated from the water heater 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.

**DHW Storage Tank** - Storage vessels shall be equipped with a drain valve to facilitate emptying the tank for cleaning or flushing debris or foreign deposits. Drain valves on counter type water heaters shall be accessible from the front of the heater. In Canada, glass-lined storage tanks for household hot water service must comply with the current performance requirements in CAN/CSA C309.

**NOTICE**

The DHW storage tank should be located in an area where leakage or connections will not result in damage to the area adjacent to the appliance or to lower floors of the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. This manufacturer is not responsible for any water damage that may occur in connection with the storage tank or any of its components.

**Tank Temperature and Pressure Relief Valve -** The storage tank will require a temperature and pressure relief valve sized to ASME specifications and that complies with the Standard for Relief Valves for Hot Water Supply Systems, ANSI Z21.22•CSA 4.4. The relief valve is to be installed on the storage tank in accordance with Figure 10-2 and must be accessible for servicing or replacement. No valve is to be place between the T&P Relief Valve and the storage tank. Check if local codes require storage tanks to have any additional valves.

**⚠ WARNING** Ensure the discharge of the temperature and pressure relief valve is piped to a drain or a location where steam or water will not cause property damage, serious injury or death.

**Tank Thermostat (Aquastat) -** The aquastat is intended to allow the water heater to monitor and control tank temperature, improve response time, and prevent short cycles of operation. Check that the aquastat will mate with the tapping on the storage tank prior to commencing installation. Install the aquastat in the storage tank as per the manufactures' instructions. Refer to Section 12.0 Field Wiring for details.

**Tank Sensor** – In lieu of a Tank Thermostat, the Lx water heater control can monitor a tank sensor installed in the storage tank. When a tank sensor is used, the tank temperature is set via the Lx control; burner demands are generated directly by the Lx controller based on controller settings.

**⚠ WARNING** Tank sensor **MUST** be used in conjunction with a DHW temperature safety shutoff switch. NTI recommends using P/N 84632 (Tank Sensor w/integrated safety switch). Failure to provide such a switch may result in property damage, serious injury to occupants, or possibly death.

**Thermostatic (Anti-Scald) Mixing Valve -** An anti-scald mixing valve is recommended when storing domestic hot water above 46°C (115°F) and should be used on branches supplying low temperature water to endpoint plumbing fixtures. A mixing valve is optional on high temperature water applications, including but not limited to process water, clothes washers, dishwashers, or sanitizers, depending on the temperature desired at the appliance and water storage temperature.

**⚠ WARNING** When the system requires water at temperatures higher than required for other uses, a means such as a mixing valve shall be installed to temper the water for those uses in order to reduce scald hazard potential. Failure to follow these instructions may result in serious injury or death.

**Figure 10-2: Stand Alone Water Heater Applications -** This piping diagram demonstrates an application with both low temperature requirements, such as bathing, and high temperature requirements, such as commercial process water heating or laundry. When the system requires water at temperatures higher than required for other uses, a thermostatic (anti-scald) mixing valve shall be installed to temper the water for those uses in order to reduce scald hazard potential, see Table 10-1. An optional DHW Recirculation Return may be used on long plumbing runs to prevent wait times for hot water on both low and high temperature water applications. Refer to Section 12.0 for field wiring instructions.

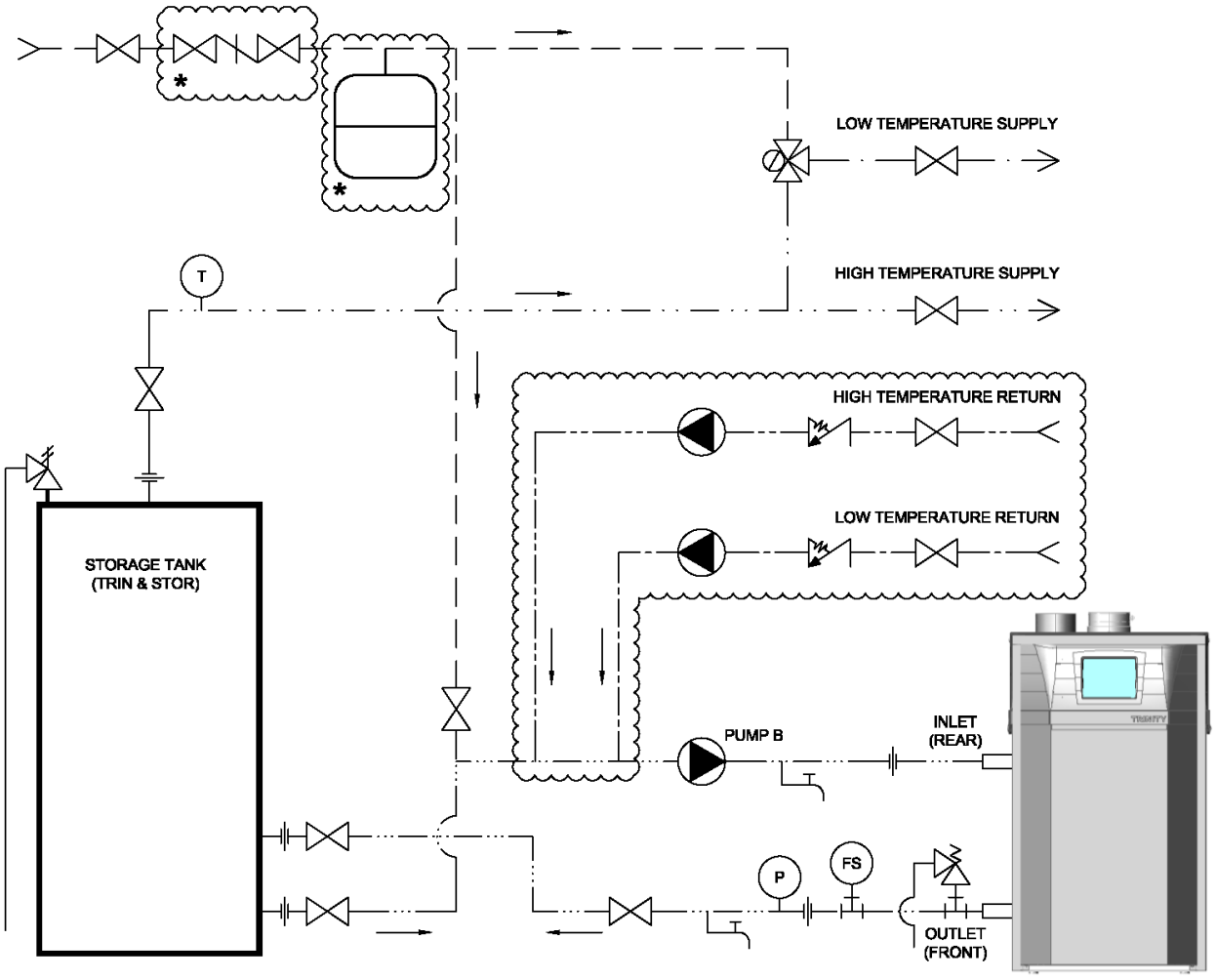
**NOTICE** The Water Heater Circulator (Pump B) must be sized according to Table 10-5 to provide adequate circulation through the water heater.

**NOTICE** Figure 10-2 illustrates a typical piping system. The Water Heater Plumbing Schematic does not illustrate all the required concepts and components required to have a proper installation. Concepts not shown include prevention of thermal-siphoning (i.e. heat traps), isolation valves, drain and purge valves, etc. It is the responsibility of the installing contractor and system designer to consider all aspects of a proper system design including compliance with local codes. Contractor modifications to these instructions may be required, based upon existing piping and system design.

**Energy Efficiency** - Although the Trinity Lx Water Heater is an energy efficient appliance, insulating long pipe runs can improve the overall system efficiency by conserving energy and reducing standby losses.

**Figure 10-2 All Models**

**Stand Alone Water Heater Plumbing Configuration**




| LEGEND | | | | | |
|---|---|---|---|---|---|
| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
| — — — | DOMESTIC COLD WATER | | PRESSURE RELIEF VALVE | FS | FLOW SWITCH |
| — · — | DHW LOW TEMPERATURE SUPPLY | C H M | THERMOSTATIC MIXING VALVE | | SPRING CHECK VALVE |
| — — — — | DHW LOW TEMPERATURE RETURN | | TEMPERATURE AND PRESSURE RELIEF VALVE | | PUMP |
| — · · — | DHW HIGH TEMPERATURE SUPPLY | | DRAIN VALVE | | UNION |
| — — — | DHW HIGH TEMPERATURE RETURN | T | TEMPERATURE GAUGE | | TEE |
| — ··· — | WATER HEATER LOOP | | EXPANSION TANK | | FLOW DIRECTION |
| | ISOLATION VALVE | | OPTIONAL | * | CHECK LOCAL CODES |
| | BACKFLOW PREVENTOR | P | PRESSURE GAUGE | | |

## 11.0 LEAD LAG INSTRUCTIONS

### Multiple Water Heater Applications

The Lx controller has the internal capacity to stage or Lead-Lag up to 8 water heaters configured in a cascade. This Lead-Lag capability allows a designated "Master" water heater to communicate with and effectively control each water heater in a multiple water heater system. This function is accomplished by "Daisy Chaining" a 3-wire cable between each of the water heaters and enabling the Master parameter in the water heater of your choice. The water heater with the Master parameter enabled becomes the single point of contact for settings and control wiring. Use the instructions detailed in this section to set-up and install the cascade water heater 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

**Plumbing** – install as many as 8 Lx water heaters in a parallel plumbing configuration as illustrated in Figure 11-1. Size common piping as per Table 11-1.

**Water Heater Pump** – each water heater 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 water heater pump must be sized according to Table 10-5.

**Communication Wiring** – using 3-wire cable, daisy-chain terminals *LL DATA* +, LL *DATA* – and *SENSOR COM* of each water heater in parallel; see *Field Wiring* Tables 12-2(a) and 12-2(b) and Figure 12-2.

**System Sensor** – a system sensor is **NOT** used in a water heater application, 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 Lx500WH-Lx800WH models] – UNCONFIGURED

**Modbus Address –** assign a unique *MB2 Modbus Address* to each water heater 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) water heater in the cascade to be the Master, this water heater will receive all control wiring and will be used for setting control parameters (see steps below). On this one water heater, set *Master enable* equal to *Enabled* via the *Lead Lag Master Configuration* menu, accessed as follows:

Configure – Lead Lag Master Configuration – Master enable

**Tank Thermostat** – connect to *SENSOR COM* and *DHW* of the Master water heater; 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 water heater 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 water heater 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 water heater only, set *DHW enable* equal to *Disabled* via the *Domestic Hot Water Configuration* menu, accessed as follows:

Configure – Domestic Hot Water Configuration – DHW enable

NOTICE

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

**Table 11-1 Minimum Pipe Sizes for Multiple Water Heater Applications**

| # of Units | Lx200WH | Lx300WH | Lx400WH | Lx500WH | Lx600WH | Lx700WH | Lx800WH |
|---|---|---|---|---|---|---|---|
| 2 | 2" | 2-1/2" | 3" | 3" | 4" | 4" | 4" |
| 3 | 2-1/2" | 3" | 4" | 4" | 4" | 4" | 4" |
| 4 | 3" | 4" | 4" | 4" | 4" | 5" | 5" |
| 5 | 3" | 4" | 4" | 4" | 5" | 5" | 5" |
| 6 | 4" | 4" | 4" | 5" | 5" | 5" | 5" |
| 7 | 4" | 4" | 5" | 5" | 5" | 6" | 6" |
| 8 | 4" | 4" | 5" | 5" | 5" | 6" | 6" |

NOTICE

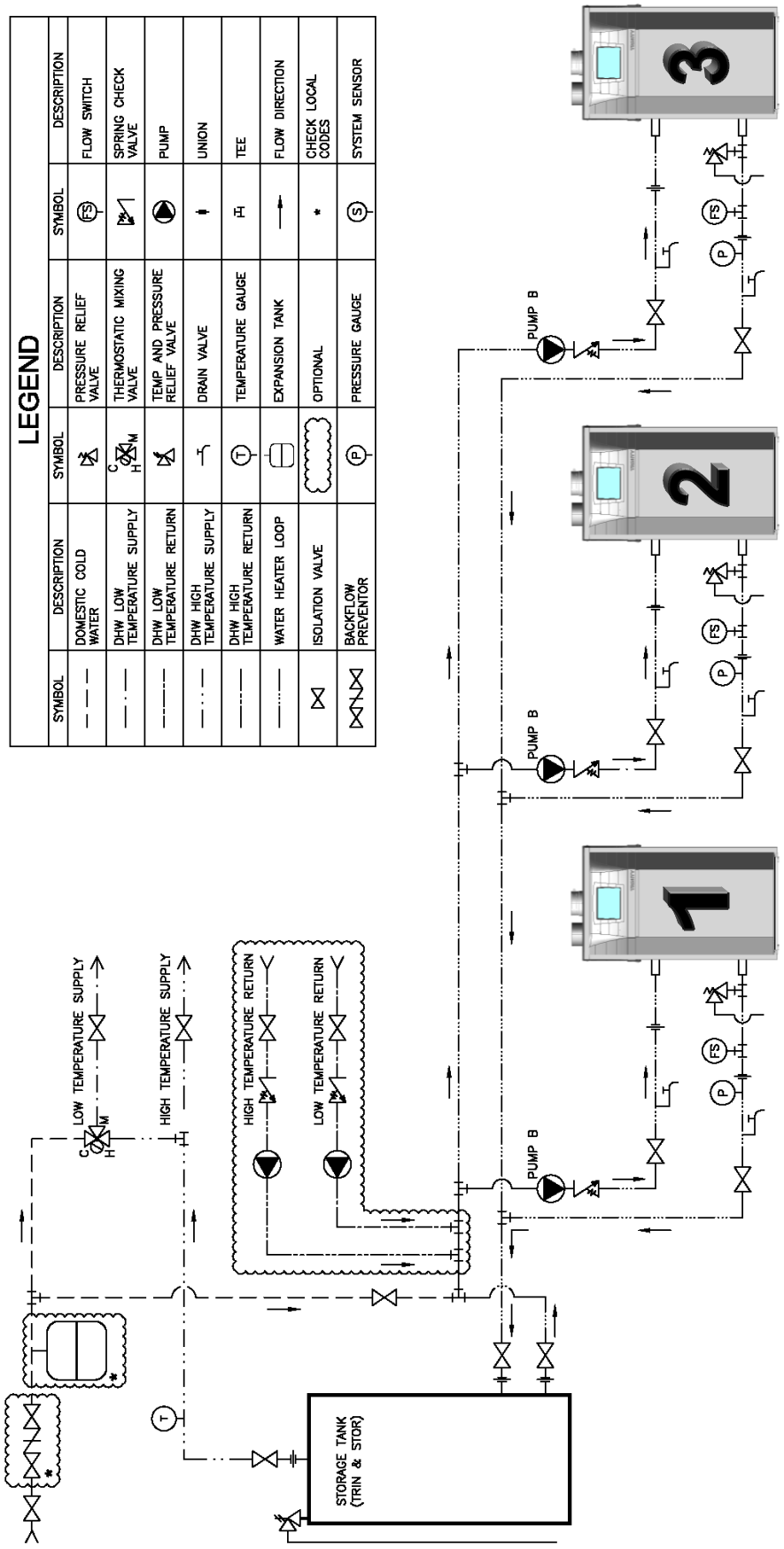
All Water Heater piping in **Multiple Water Heater Applications** must be sized based on Table 11-1 in accordance with the number of units the piping supports.

NOTICE

All water heater circulators (Pump B) must be sized according to Table 10-5.

**Figure 11-1 All Models**

**Multiple Water Heater Lead-Lag Plumbing Configuration**



## 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 water heater 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 water heater 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 water heater cabinet on Lx200WH models and can be accessed by removing the front door of the water heater, followed by the removal of the line voltage junction box cover. On Lx300WH & Lx400WH models, the line voltage junction box is located at the top of the water heater cabinet on the right hand side and can be accessed by removing the top front cover of the water heater. On Lx500WH-Lx800WH models, the line voltage junction box is located at the back of the water heater cabinet on the power switch side. Remove the top back cover of the water heater 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.

Lx200WH-Lx400WH Control Panel:

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

Lx500WH-Lx800WH Control Panel:

- Fuse A: Protects the 120VAC circuits within the water heater.

**Pump Relays (Lx500WH-Lx800WH)** – In lieu of the 120VAC pump outputs, the Lx500WH-Lx800WH 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 water heater, 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** – Lx200WH-Lx400WH circulator outputs are each limited to operating a circulator with a maximum current load of 5 Amps or a maximum 2/5 hp motor. See Table 12-1.

**Figure 12-1(a) Line Voltage Field Wiring (Lx200WH-Lx400WH)**

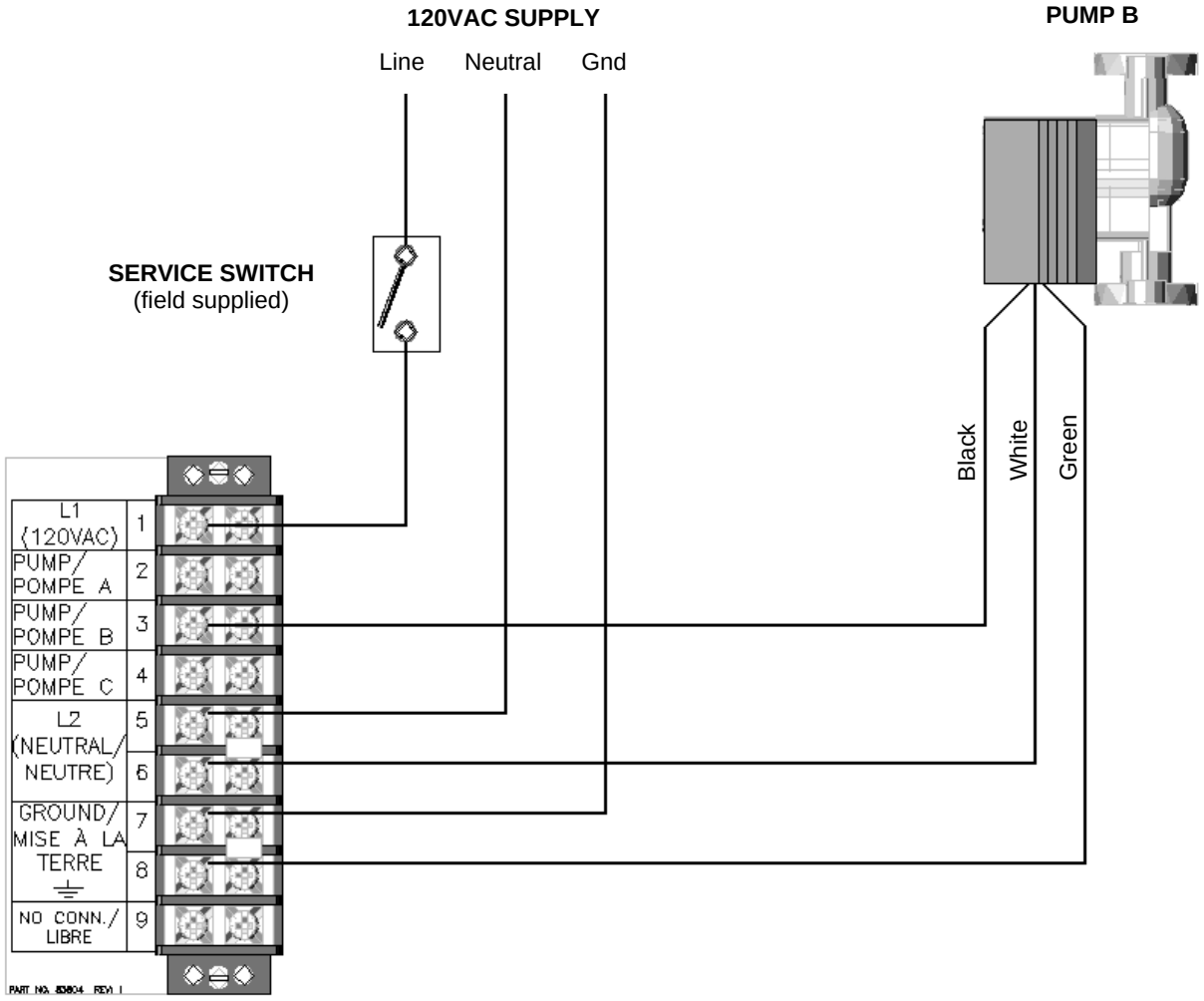



**Table 12-1 Line Voltage Field Connections**

| Connection | Location | Description |
|---|---|---|
| L1 (120VAC) | 1 | **120VAC Hot** - Location for connecting line voltage of the power supply. Note most installation codes require the installation of a service switch to break line voltage to the appliance. |
| PUMP A | 2 | **Not used.** |
| PUMP B | 3 | **DHW Demand** - Output to the Water Heater Circulator, powered during tank demand. |
| PUMP C | 4 | **Not used.** |
| L2 (Neutral) | 5 | **120VAC Common** - Location for connecting neutral of the power supply and circulator. |
| | 6 | |
| Ground | 7 | **120VAC Ground** - Location for connecting ground of the power supply and circulator. |
| | 8 | |
| No Conn. | 9 | **Factory Wiring** - This terminal is used only for factory wiring. Do not add or remove wires from this location. |

**Figure 12-1(b) Line Voltage Wiring (Lx500WH-Lx800WH)**

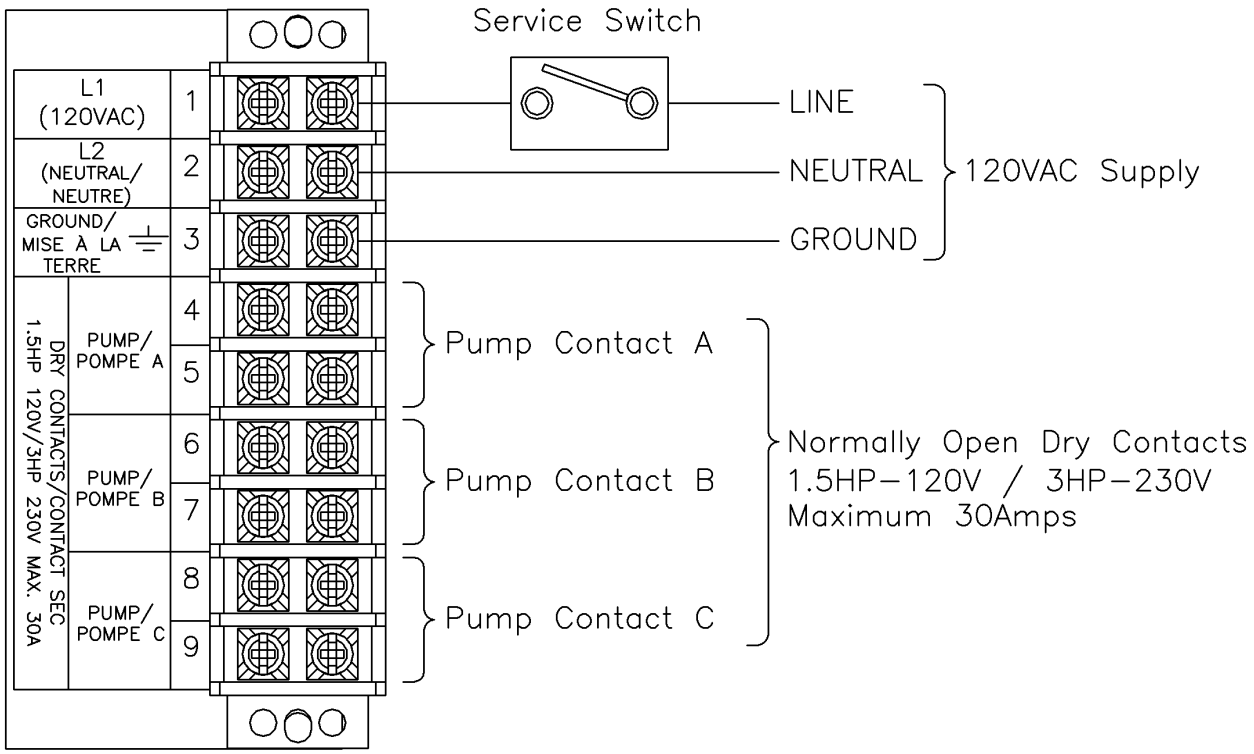



**Table 12-1(b) Line Voltage Field Connections (Lx500WH-Lx800WH)**

| Connection | | Location | Description |
|---|---|---|---|
| L1 (120VAC) | | 1 | **120VAC Hot** - Location for connecting line voltage of the power supply. Note most installation codes require the installation of a service switch to break line voltage to the appliance. |
| L2 (Neutral) | | 2 | **120VAC Common** - Location for connecting neutral of the power supply and circulator. |
| Ground | | 3 | **120VAC Ground** - Location for connecting ground of the power supply and circulator. |
| Non-Powered Dry Contacts | PUMP A | 4 | **Not used.** |
| | | 5 | |
| | PUMP B | 6 | **DHW Demand** - Dry Contact for Water Heater circulator; Coil B powered during tank demands. |
| | | 7 | |
| | PUMP C | 8 | **Not used.** |
| | | 9 | |

## Low Voltage Connections

The Trinity Lx low voltage junction box is located in the lower left corner of the water heater cabinet on Lx200WH models and can be accessed by removing the front door of the water heater, followed by the removal of the low voltage junction box cover. On Lx300WH & Lx400WH models, the low voltage junction box is located at the top of the water heater cabinet on the left hand side and can be accessed by removing the top front cover of the water heater. On Lx500WH-Lx800WH models, the low voltage junction box is located at the back of the water heater cabinet and can be accessed by removing the top back cover of the water heater. Each water heater 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 (Lx200WH-Lx400WH)**

| Connection | | Location | Description |
|---|---|---|---|
| COM (24VAC) | | 1 | **24VAC Common** – Neutral for the 24VAC power supply within the water heater. |
| 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. Remove the factory installed jumper and install the normally open isolated contacts of the field supplied Safety Flow Switch. |
| CH1 * | | 5 | **Local Central Heat Demand** – Not applicable for Water Heater Applications. |
| CH2 (LL) * | | 6 | **Lead-Lag Central Heat Demand** – Not applicable for Water Heater Applications. |
| 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 the storage tank thermostat (Aquastat). Or optional Tank Sensor (P/N 84632), see Appendix A.<br>**NOTICE:** Tank Sensor – when operating in a cascade system, the water heater controls do not support the use of a tank sensor: a tank thermostat (switch) must be used. |
| | OD SENSOR * | 8 | **Outdoor Temperature Sensor** – Not applicable for Water Heater Applications. |
| | SYSTEM * | 9 | **System Water Temperature** – Not applicable for Water Heater Applications. |
| | SENSOR COM | 10 | **System Common** – Common port for field inputs DHW, OD Sensor and System Sensor. |
| 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 water heaters (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 (Lx500WH-Lx800WH)**

| Connection | | Location | Description |
|---|---|---|---|
| COM (24VAC) | | 1 | **24VAC Common** – Neutral for the 24VAC power supply within the water heater. |
| R1/R2 (24VAC) | | 2<br>3 | **24VAC Hot** - Power supply for inputs EXT. LIM, CH1, and CH2 (LL). |
| 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. Flow Switch factory installed and prewired in series with EXT LIMIT jumper. |
| GAS LO PR.[1] | | 5<br>6 | **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. |
| AUX. PROOF | | 7<br>8 | **Auxiliary Proof** – Comes factory equipped with a jumper. For applications using Indoor Combustion Air (Lx500-800 only), remove jumper and replace with field supplied end switch incorporated with motorized damper/louver control. |
| CH1 * | | 9 | **Local Central Heat Demand** – Not applicable for Water Heater Applications. |
| CH2 (LL) * | | 10 | **Lead-Lag Central Heat Demand** – Not applicable for Water Heater Applications. |
| Sensor | DHW[2] | 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 the storage tank thermostat (Aquastat). Or optional Tank Sensor (P/N 84632); see Appendix A. |
| Sensor | OD / SYS SENSOR * | 12 | **Outdoor Temperature Sensor** – Not applicable for Water Heater Applications.<br>**System Water Temperature** – Not applicable for Water Heater Applications. |
| Sensor | 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. |
| Sensor | SENSOR COM | 14 | **System Common** – Common port for field inputs DHW, OD Sensor and System Sensor. |
| 4-20mA (– / +) | | 15<br>16 | **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. |
| 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 water heaters (up to 8 in total) for the purpose of staging. |
| Communications | LL DATA- | 18 | |
| Communications | 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. |
| Communications | BMS D- | 20 | |
| ALARM (A & B) | | 21<br>22 | **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. |

**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: this is the only High Gas Pressure Switch that has been tested with the unit and preapproved for field installation within the appliance cabinet.

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

* Asterisk indicates connection not used or applicable for Water Heater Applications.

CAUTION

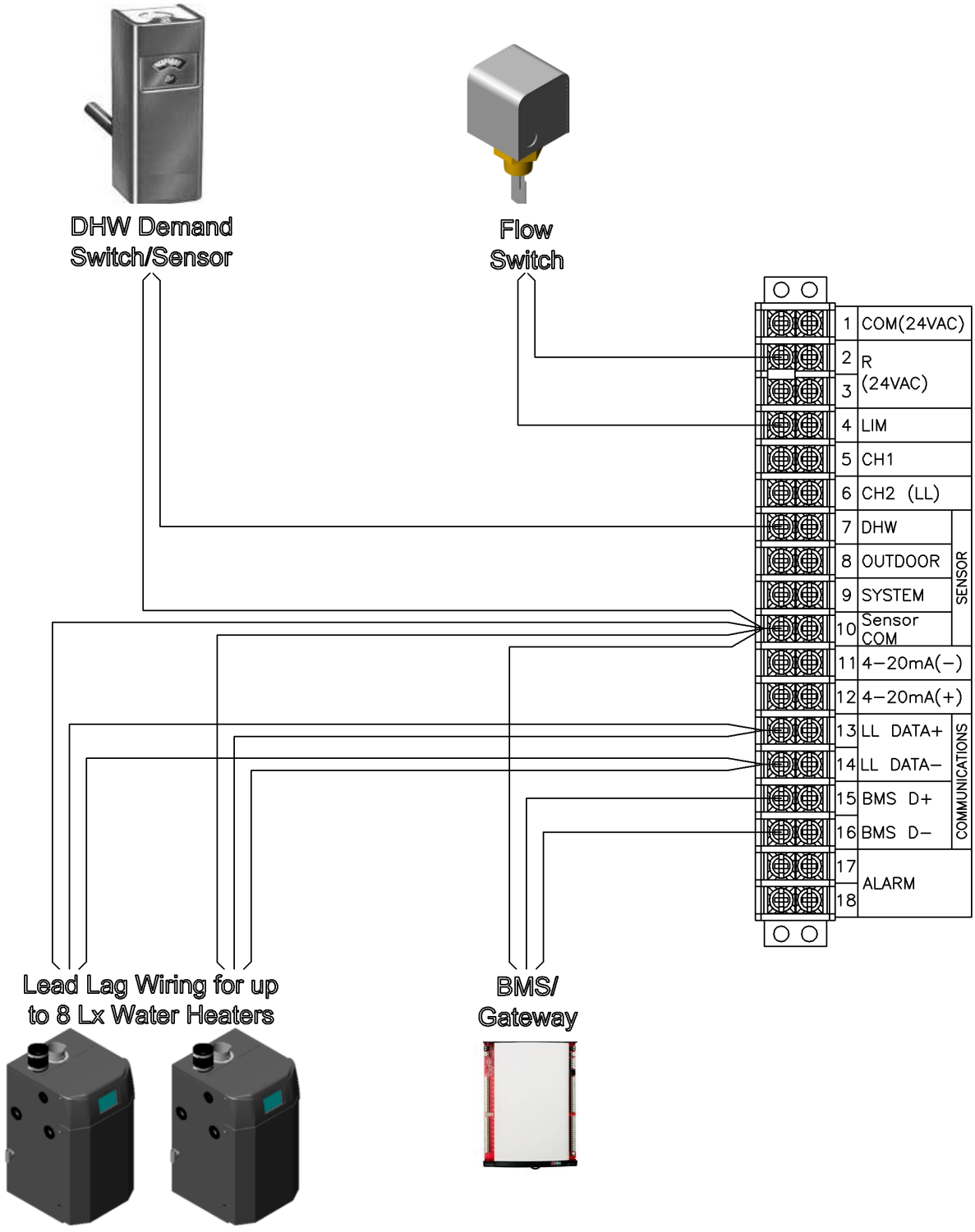
**Low Voltage Terminals** - Terminals 2 and 3 (R) have 24VAC potential from the internal transformer. Do not connect power from these terminals to any other terminal other than terminals 4, 5 and 6 [LIM, CH1, and CH2 (LL)]. Failure to follow these instructions may damage the unit.

NOTICE

**Fuse (24VAC)** - Trinity Lx200WH-Lx400WH 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)**

**Lx200WH-Lx400WH Illustrated**



## 13.0 WIRING SCHEMATICS

**Figure 13-1(a) Connection Diagram (Lx200WH-Lx400WH)**

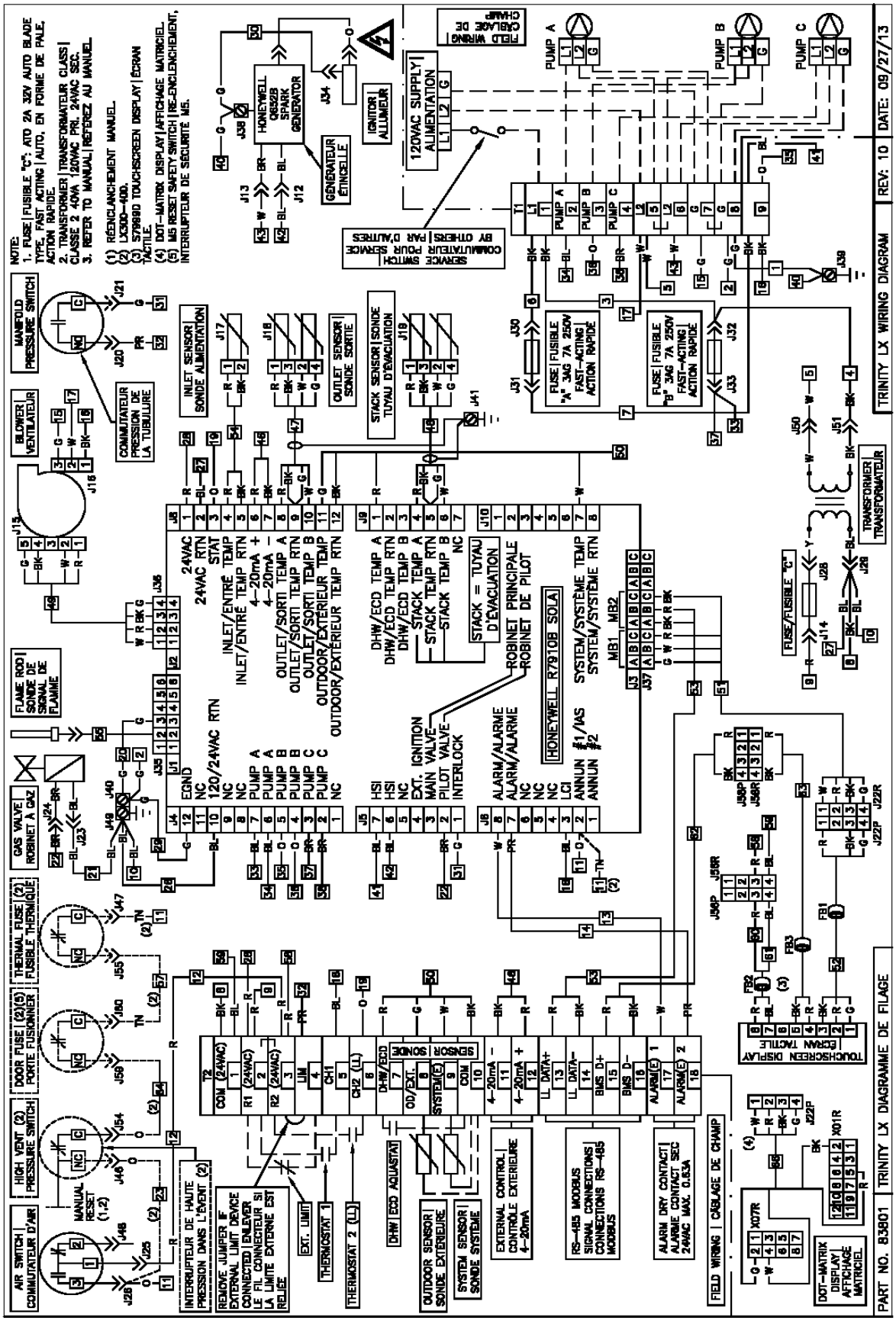


**Figure 13-1(b) Ladder/Logic Diagram (Lx200WH-Lx400WH)**

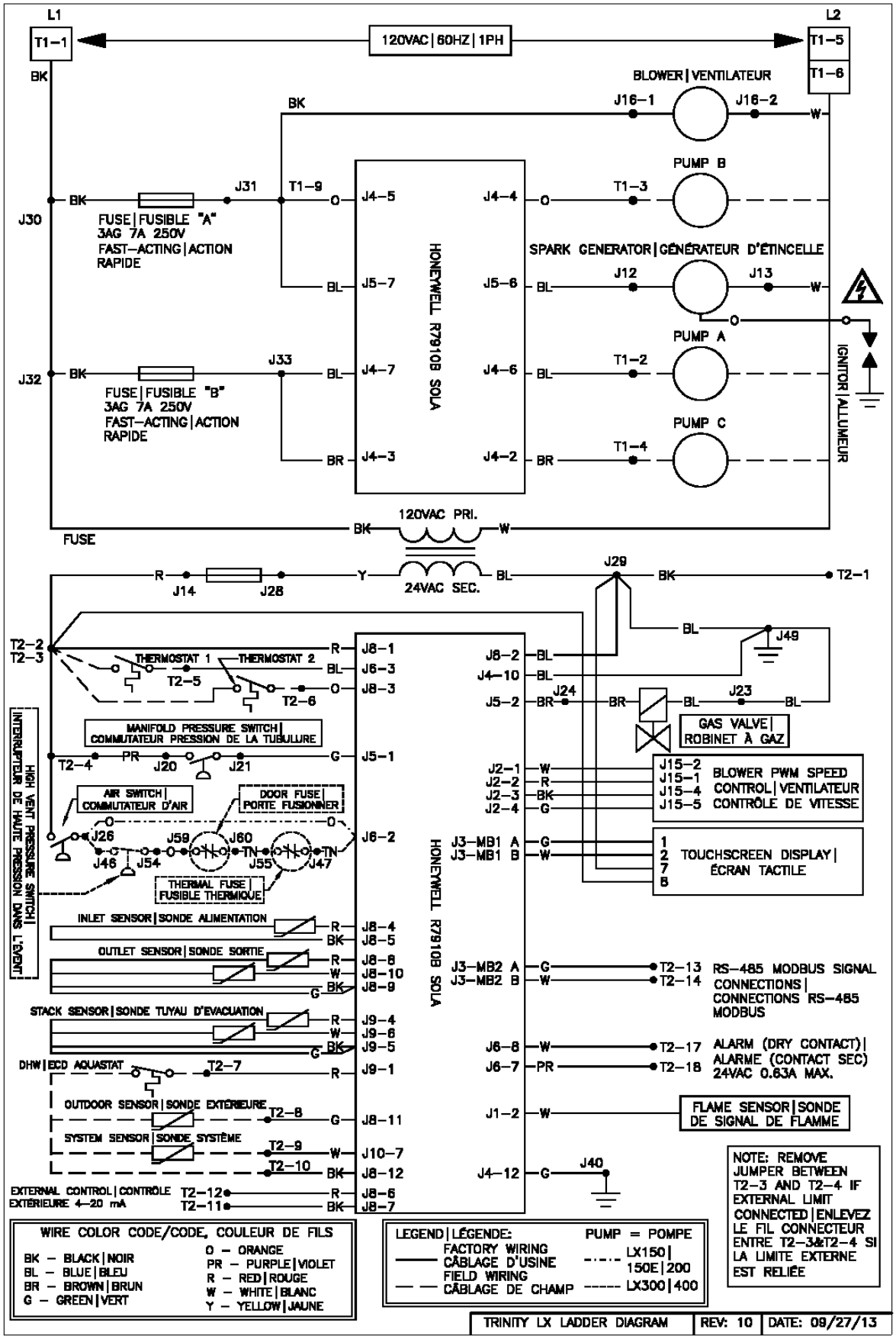


**Figure 13-2(a) Connection Diagram (Lx500WH-Lx800WH)**

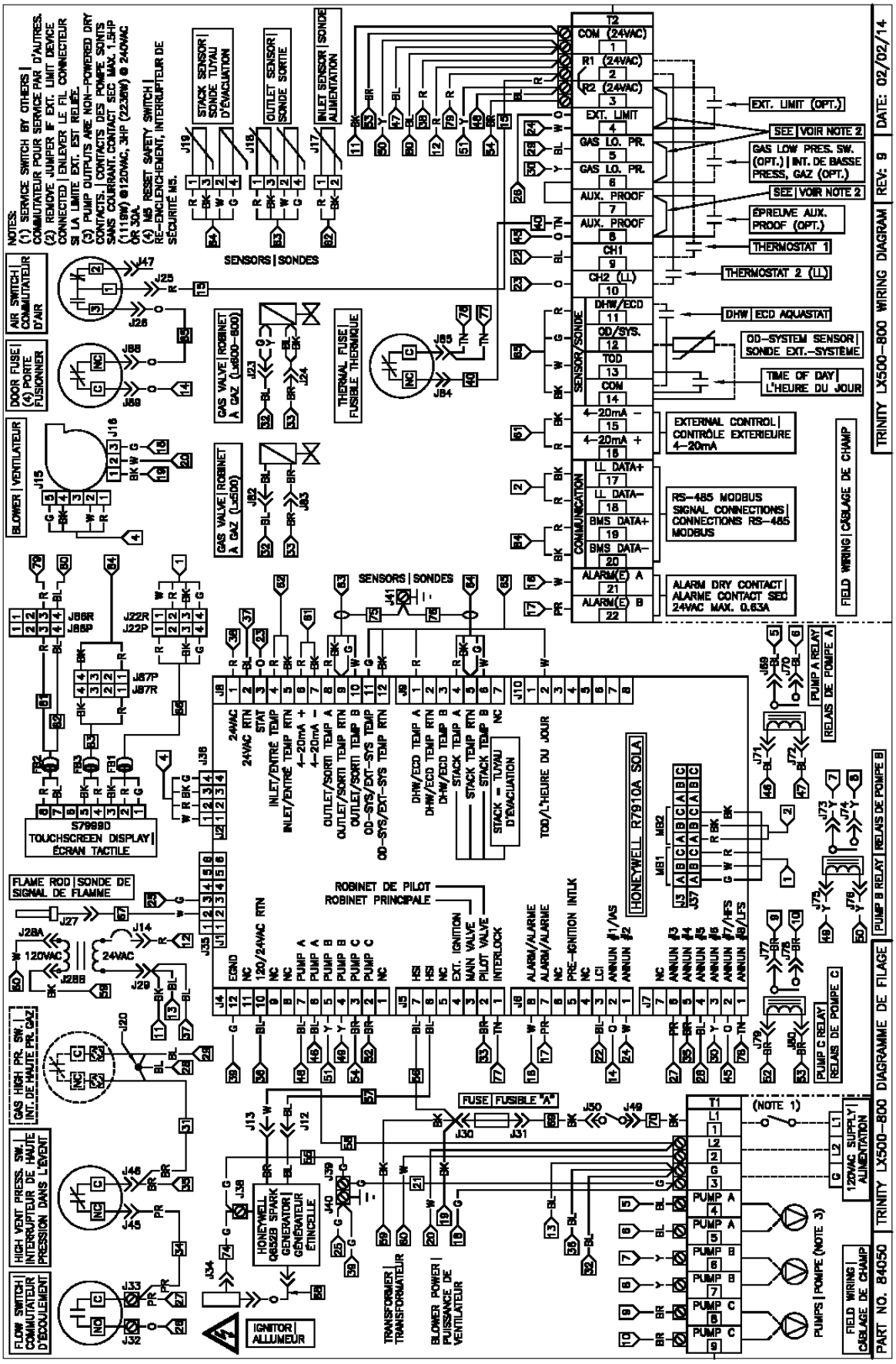
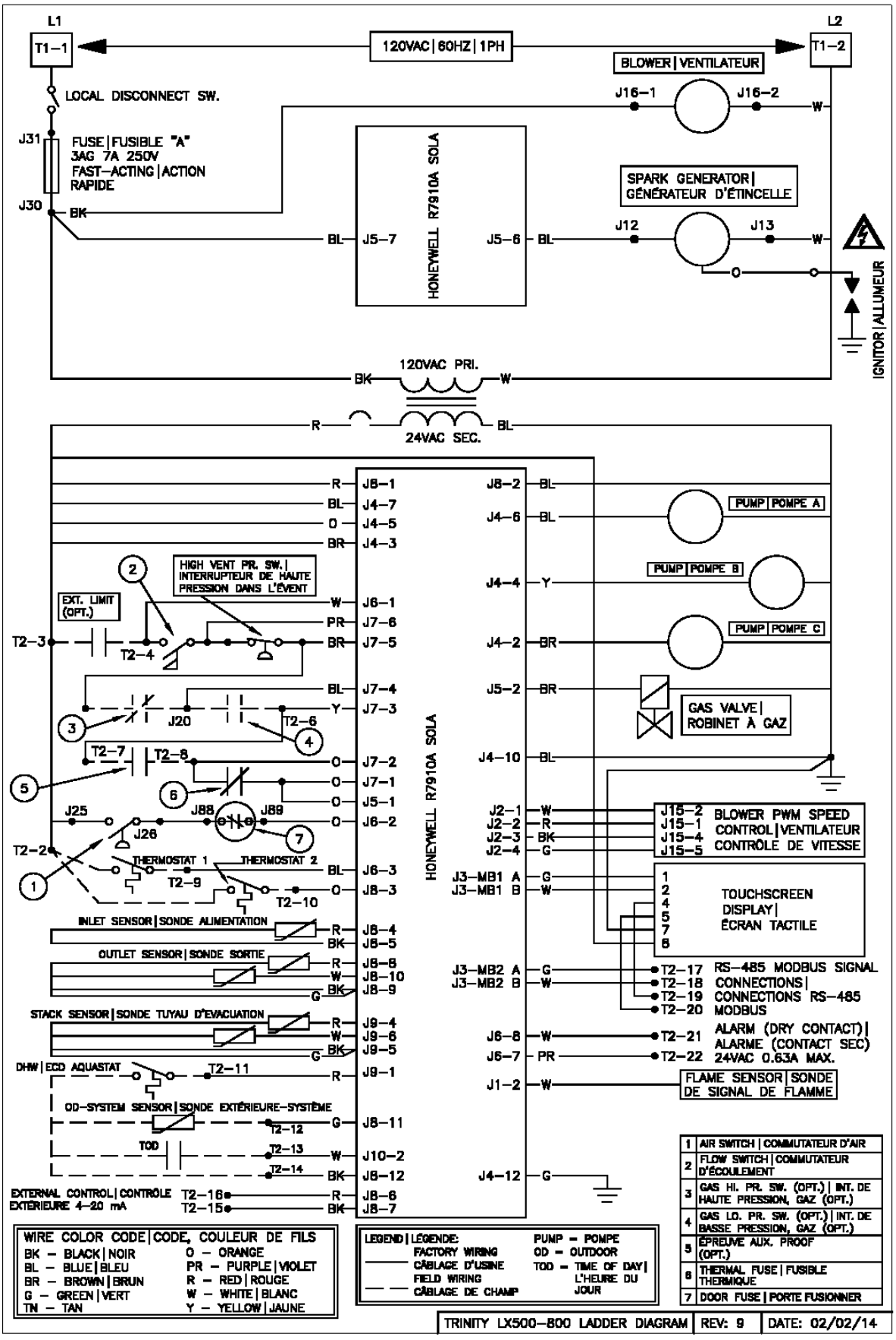


**Figure 13-2(b) Ladder/Logic Diagram (Lx500WH-Lx800WH)**



## 14.0 INSTALLATION CHECKLIST

### Installation

- ☐ 1. If operating on Propane Gas, convert water heater using appropriate Kit number. See Table 7-1.
- ☐ 2. Locate the water heater 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 piping system.
- ☐ 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 water heater.

**⚠ WARNING** 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 water heater (see Section 15.0). Failure to properly maintain the water heater may result in serious injury or death.

### Start-up

**⚠ DANGER** Allow primers/cements to cure for 8 hours prior to Start-up. If curing time is less than 8 hours, first perform Steps 2 through 6 of **Mandatory Pre-commissioning Procedure for Plastic Venting** in Section 4.0. Failure to follow these instructions can result in explosion, serious injury or death.

- ☐ 1. Turn gas shut-off valve to the ON position.
- ☐ 2. Turn Power on to water heater.
- ☐ 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 water heater to complete at least one heating cycle, or to operate for at least 15 minutes.
- ☐ 4. Always verify proper operation after servicing.

### Instructions to Installing Contractor

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

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

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

## 15.0 ANNUAL MAINTENANCE AND INSPECTION

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

### Annual Inspection Checklist

- ☐ 1. Ignition is smooth and consistent, and the combustion fan is noise & vibration free.
- ☐ 2. The condensate trap (siphon) and drain piping are cleaned of sediment, and that the condensate flows freely. If a condensate neutralizer is utilized, check the pH of the exiting condensate, if below 5 replace the neutralizer media.
- ☐ 3. Relief Valve and air vents are not weeping. If a relief valve discharges periodically, this may be due to thermal expansion in a closed water supply system. Correct this situation and DO NOT PLUG THE RELIEF VALVE!
- ☐ 4. Low water cut off device is tested
- ☐ 5. Examine all venting for evidence of leaks. Ensure vent screens are cleaned and clear of debris.
- ☐ 6. Check the burner plate for signs of leaking.
- ☐ 7. The combustion chamber must be cleaned (cleaning frequency based on need for application – see below).
- ☐ 8. Keep boiler area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
- ☐ 9. Ensure there is nothing obstructing the flow of combustion and ventilation air.

  **Note**: inform owner about the need to keep the termination unobstructed, including preventing blockage by snow buildup.
- ☐ 10. Listen for water flow noises indicating a reduction in water flow rate or scaling. The heat exchanger may need to be flushed to eliminate hard water scale.
- ☐ 11. **Verify proper operation after servicing.**

### Combustion Chamber Cleaning Procedure

Units operating with LP Gas or in an industrial environment will have to be cleaned a minimum of once per year. Other applications will require the combustion chamber to be cleaned after the first year of operation, with subsequent cleanings scheduled based on the condition of the combustion chamber at the time. Unless a step is identified as model specific, the following combustion chamber cleaning procedure is the same for all models.

IMPORTANT

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

### Cleaning Checklist

- ☐ 1. Initiate a post-purge cycle to clear any gas from the combustion chamber, then turn gas valve off.
- ☐ 2. **Danger Explosion Hazard (Lx300WH-Lx800WH):** To disconnect the fuel-air metallic tubing between the blower and the high-vent pressure switch, loosen the compression fitting at the high-vent pressure switch with a 1/2" wrench. At the blower end, support the brass fitting body with a 1/2" wrench to keep it from rotating while loosening the compression fitting nut with a 9/16" wrench. Remove tubing assembly from blower.
- ☐ 3. Access the combustion chamber by removing the aluminum burner door assembly of the water heater.
- ☐ 4. Remove (or cover) the insulation disc located in the back of the combustion chamber to avoid damaging it during the cleaning process. The disc is held in place with a 2.5mm "Allen-head" screw.
- ☐ 5. Use a vacuum with a high efficiency filter to remove any loose debris or dust.
- ☐ 6. Wet the inside of the combustion chamber with water. Use a garden hose with a trigger nozzle to direct pressurized water through the gaps between the heat exchanger tubes. The water should pass in-between the heat exchanger tubes and exit via the condensate drain. This process may require the use of some dry rags or plastic to protect electrical components from being damaged by dripping or spraying water.

- ☐ 7. Use a nylon or other non-metallic brush to loosen the incrustations and any other contaminates that have remained stuck on and in-between the tubes.
- ☐ 8. Repeat steps 6 and 7 until the heat exchanger is clean and water from the condensate drain runs clear.
- ☐ 9. Re-install the insulation disc to the back of the combustion chamber (see Table 16-1, Item 31 for part #).
- ☐ 10. Inspect the insulation disc located on the back side of the burner door. Replace if damaged (see Table 16-1, Item 33 for part # by applicable model).
- ☐ 11. Re-install the burner door, gas-supply and Air-inlet pipe, check for gas leaks.
- ☐ 12. **Lx300WH-Lx800WH:** Reconnect the fuel-air metallic tubing between the blower and the high-vent pressure switch. Ensure the brass fitting body at the blower remains stationary and does not rotate during reconnection.
- ☐ 13. Perform the Operational Check List detailed in Section 14.0.

⚠ DANGER

**Explosion Hazard** (Lx300WH-Lx800WH) - The fuel-air metallic tubing connecting the blower and the high-vent pressure switch contains a mixture of fuel and air. Refer to ***Combustion Chamber Cleaning Procedure*** for instructions on connecting and disconnecting the metallic tubing. Failure to follow these instructions will result in serious injury or death.

⚠ WARNING

Replace any gaskets or insulation discs that show any signs of damage and do not re-use. Failure to follow these instructions may result in fire, property damage or death.

### Refractory Ceramic Fibers (RFC)

IMPORTANT

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

⚠ WARNING

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

⚠ WARNING

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

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

| Reduce the Risk of Exposure | Precautions and Recommended Personal Protective Equipment |
|---|---|
| Avoid contact with skin and eyes | • Wear long-sleeved clothing, gloves, and safety goggles or glasses. |
| Avoid breathing in silica dust | • Wear a respirator with a N95-rated filter efficiency or better. [1]<br>• Use water to reduce airborne dust levels when cleaning the combustion chamber.<br>• Do not dry sweep silica dust. Pre-wet or use a vacuum with a high efficiency filter. |
| Avoid transferring contamination | • When installing or removing RFCs, place the material in a sealable plastic bag.<br>• Remove contaminated clothing after use. Store in sealable container until cleaned.<br>• Wash contaminated clothing separately from other laundry. |
| First Aid Measures | If irritation persists after implementing first aid measures consult a physician.<br>• **Skin** - Wash with soap and water.<br>• **Eyes** - Do not rub eyes; flush with water immediately.<br>• **Inhalation** – Breathe in fresh air; drink water, sneeze or cough to clear irritated passage ways. |

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

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

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

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

## Descaling

All water heaters are subject to scale build up when using hard or untreated water. Applications using harder water will require de-scaling more frequently. Scale formation is a function of temperature and water hardness (scale formation is minimized when storage temperatures below 120F). In locations using hard untreated water, descaling should be done annually. Applications using soft or treated water will require less frequent cleaning and the service interval may be extended, however it is recommended that all water heaters be descaled and flushed at least once every five years. Water softening and other scale inhibiting treatments are recommended, when the water quality falls outside the recommended chemistry guidelines in this manual, to prevent heat exchanger failure. Descaling frequency is dependent on water quality, temperature and usage; if at any time you experience symptoms such as kettling or banging and hissing, descaling is required immediately.




Use a descaling agent that is safe for potable and stainless-steel systems.
Ideally, isolation and flush valves have been installed by the installer to facilitate descaling and flushing.

**Descaling Procedure**

1. Turn the water heater off.
2. Isolate the water heater from the domestic hot water system including any re-circulation lines in use.
3. Connect an external recirculation pump to the water heater supply and return so that water will flow through the heater in reverse.
4. Use a water heater cleaning solution suitable for Stainless steel, white vinegar as an example, and fill a bucket with the solution so that it can be pumped through the water heater.
5. Flush the water heater in reverse for a minimum of 30 minutes. Several hours may be required for heavily scaled water heaters.
6. Remove the external pump and using a fresh water source flush the water heater forward and backward at a high flow rate until any loose particles and debris are purged.
7. Close the flush valves purge the water heater of air and return it to normal operation.

## 16.0 PARTS LIST

For a list of parts that corresponds to the item numbers in the bubbles, refer to Table 16-1. Note that that some item numbers may appear more than once in the parts list depending on which model number is being referenced.

**Building Owners** - Replacement parts are available from your stocking wholesaler. Contact your local Installer or Wholesaler for assistance with parts.

**Wholesalers** - Contact NY Thermal Inc. directly when ordering replacement parts, 1-506-657-6000.

**Installers** - Contact NY Thermal Inc. directly if technical assistance required, 1-800-688-2575.

### Residential Models (Lx200WH-Lx400WH)

**Figure 16-1 Cabinet, Vent and Air-inlet Parts (Lx200WH)**

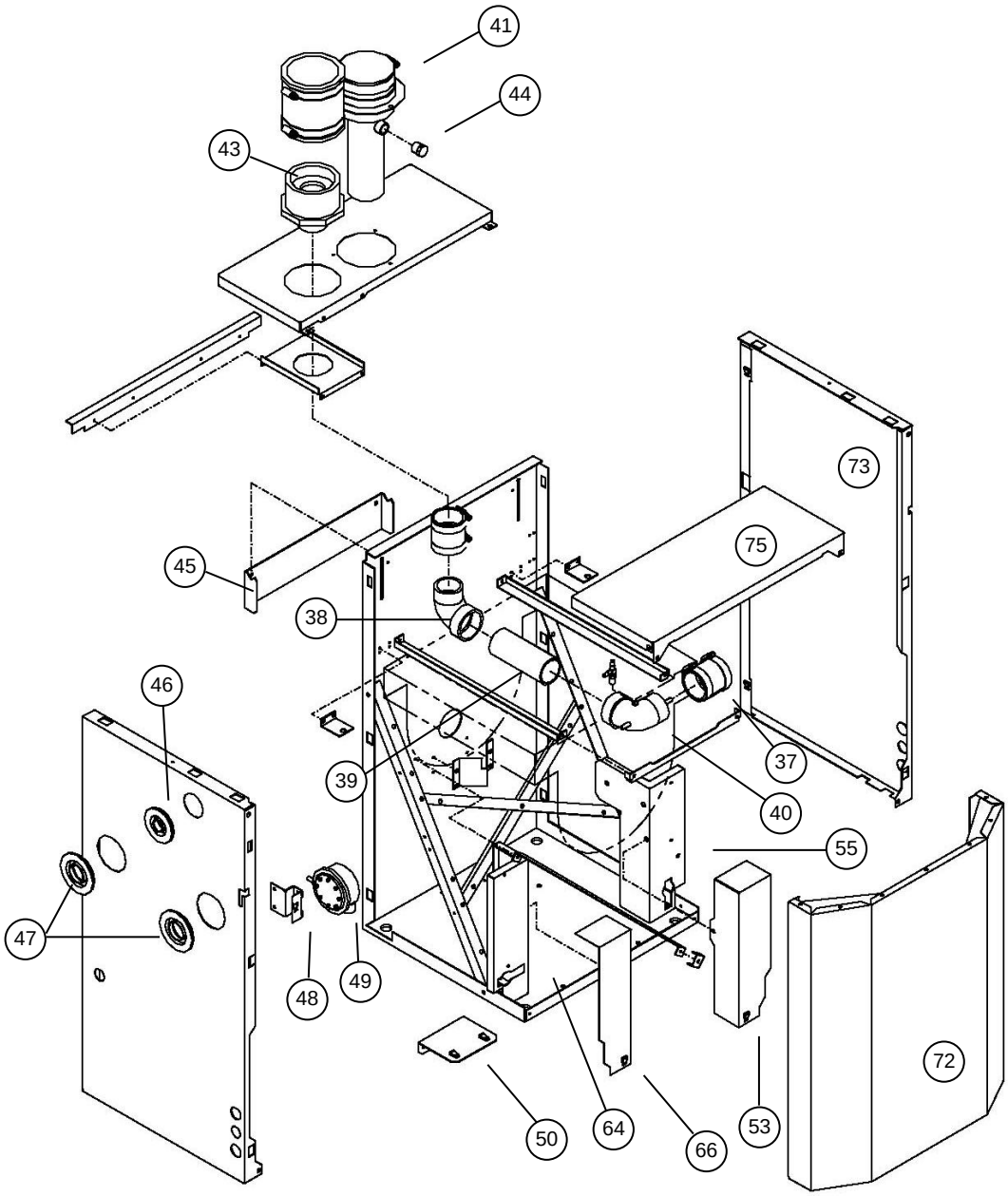


**Figure 16-2 Heat Exchanger, Gas Valve, Blower and Burner Assembly (Lx200WH)**

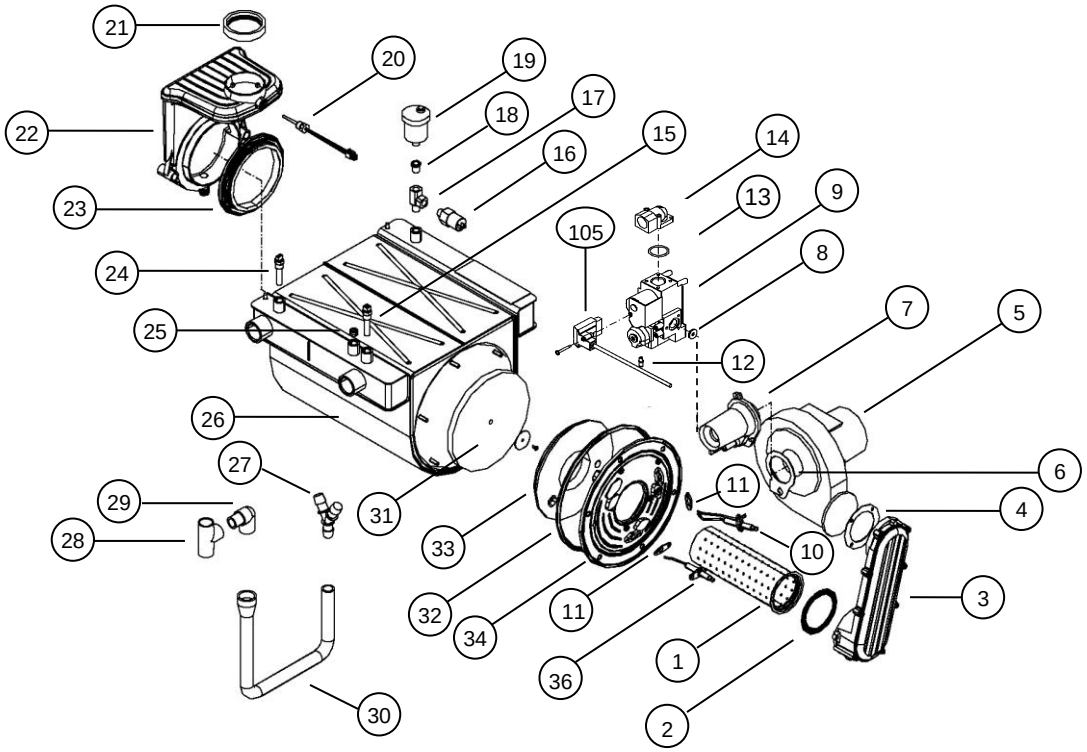



**Figure 16-3 Electrical Housing, Controller, and Display Module (Lx200WH-Lx400WH)**

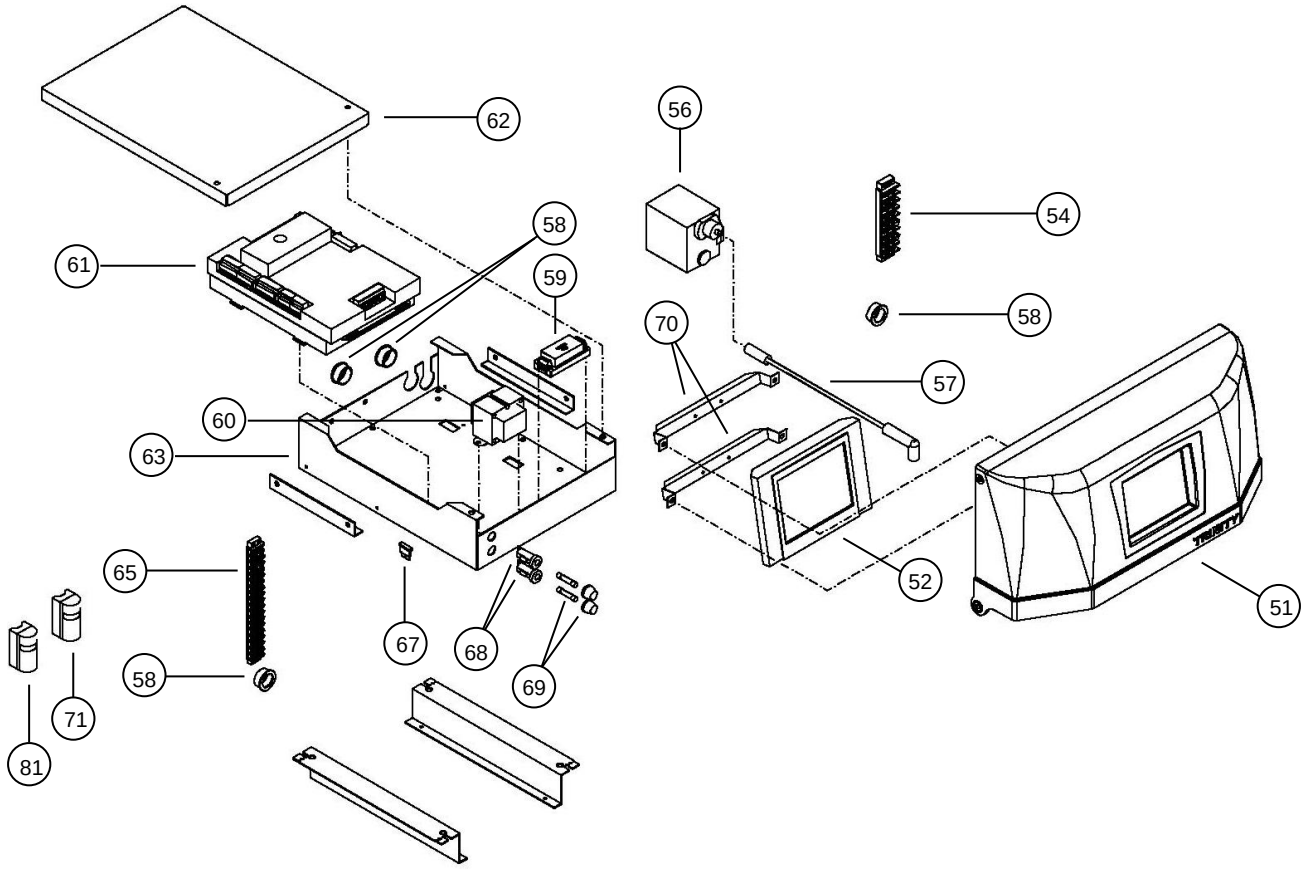


**Figure 16-4 Cabinet, Vent and Air-Intake Parts (Lx300WH & Lx400WH)**

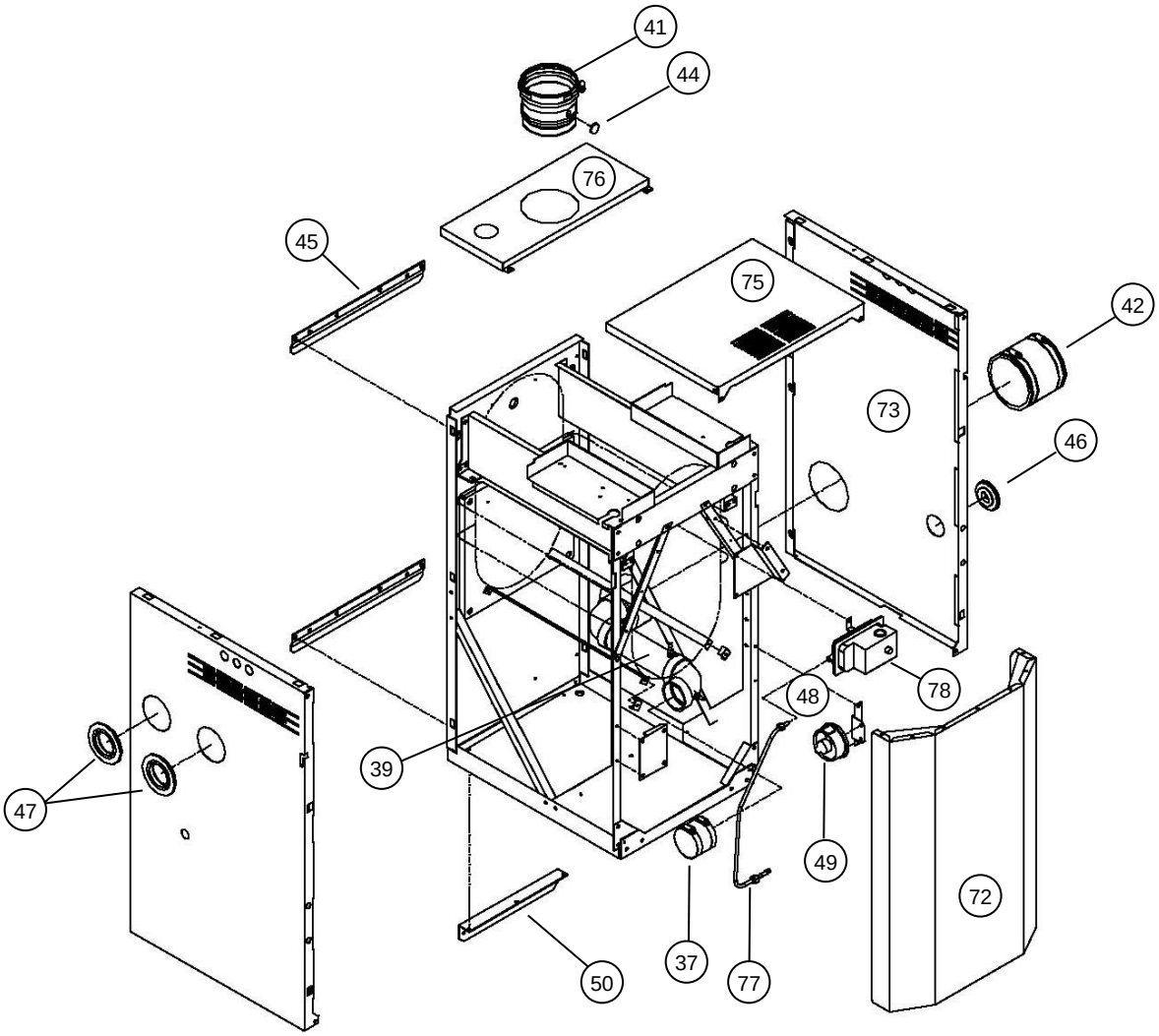
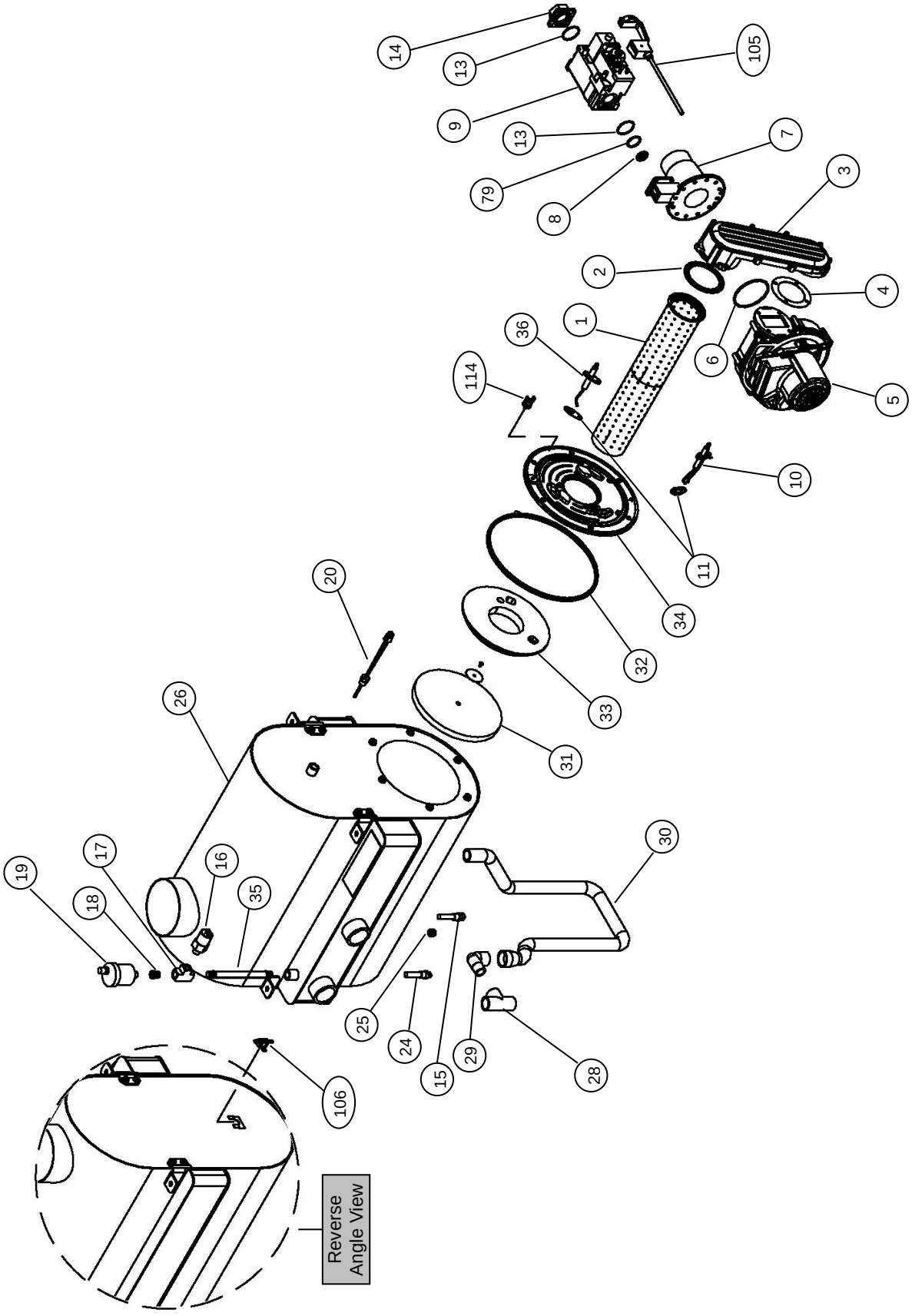


**Figure 16-5 Heat Exchanger, Gas Valve, Blower and Burner Assembly (Lx300WH-Lx400WH)**



## Commercial Models (Lx500WH-Lx800WH)

**Figure 16-6 Cabinet, Vent and Air-inlet Parts (Lx500WH-Lx800WH)**

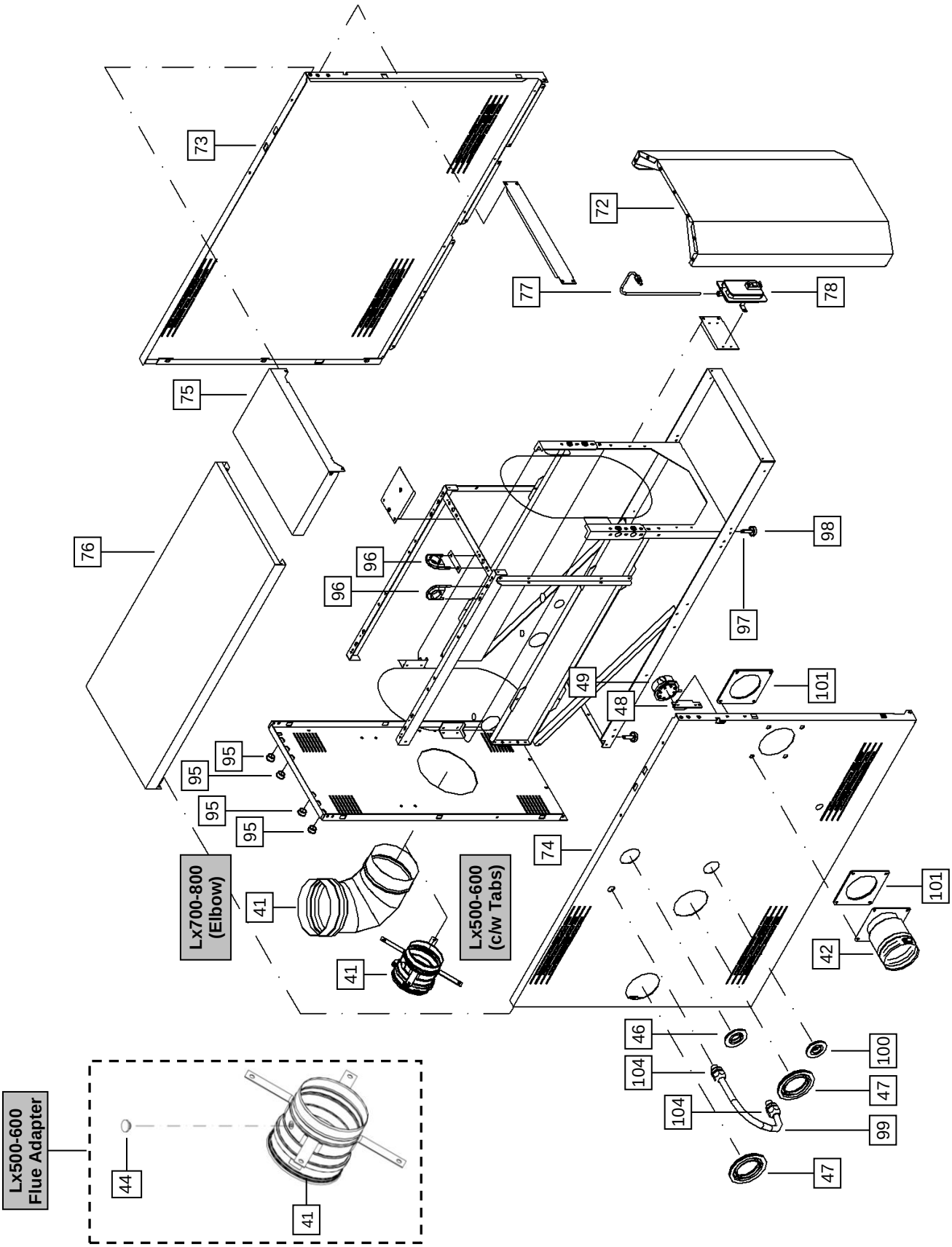


**Figure 16-7 Heat Exchanger, Gas Valve, Blower and Burner Assembly (Lx500WH)**

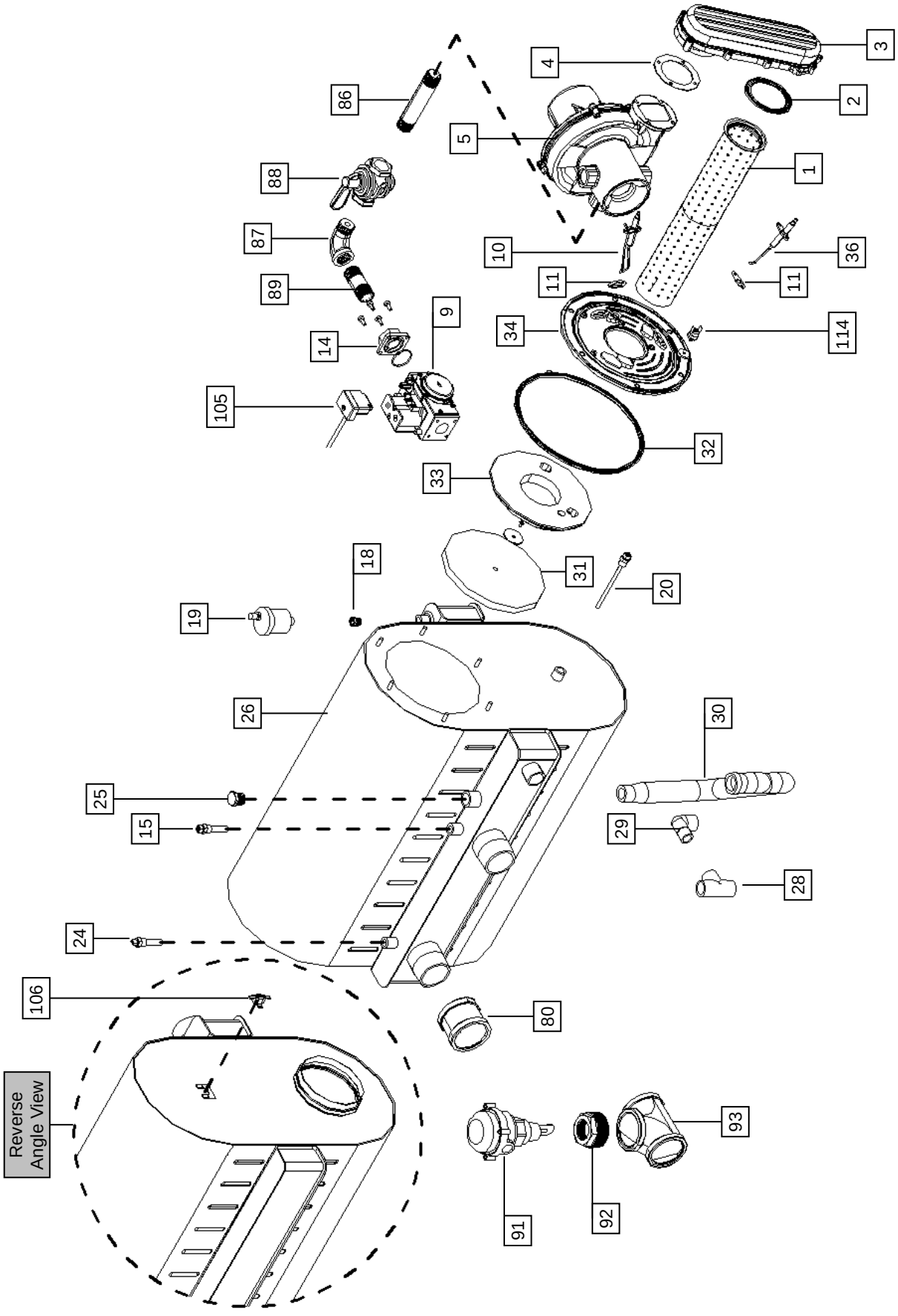


**Figure 16-8 Heat Exchanger, Gas Valve, Blower and Burner Assembly (Lx600WH-Lx800WH)**

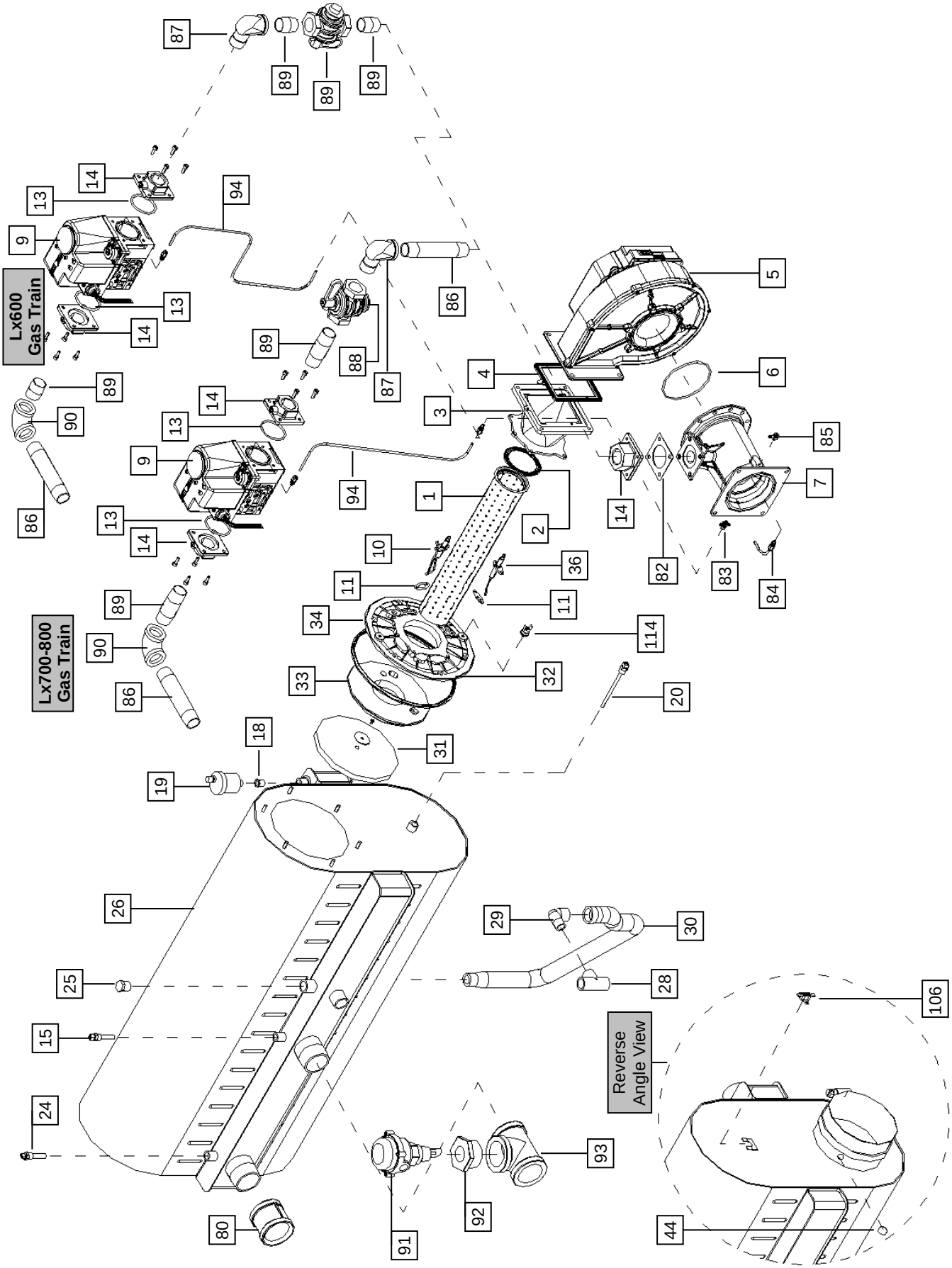


**Figure 16-9 Electrical Housing, Controller, and Display Module (Lx500WH-Lx800WH)**

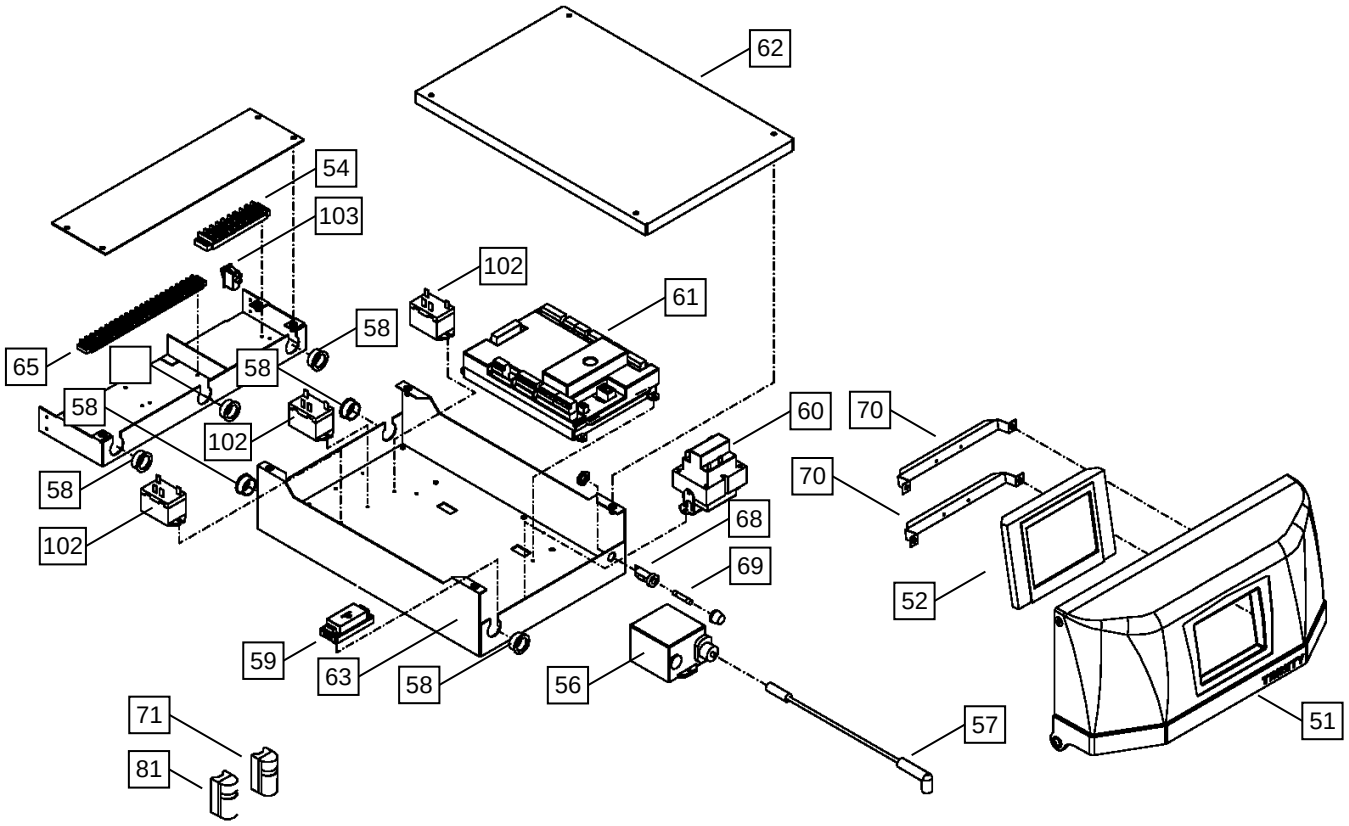



**Table 16-1 Parts List: Trinity Lx**

| Item | Part # | Models | Description |
|---|---|---|---|
| 1 | 82657 | 150 | Premix burner 135.8 (Lx100-150; not Lx150E) |
| 1 | 82658 | 150E, 200 | Premix burner, 200.6 (Lx150E, Lx200) |
| 1 | 84207 | 300 | Premix burner, (Lx300) |
| 1 | 83338 | 400, 500 | Premix burner (Lx400-500) |
| 1 | 84383 | 600 | Premix burner (Lx600) |
| 1 | 84134 | 700, 800 | Premix burner (Lx700-800) |
| 2 | 82761 | 150–500 | Premix Burner Gasket (Lx150-500) |
| 2 | 84133 | 600–800 | Premix Burner Gasket (Lx600-800) |
| 3 | 82771 | 150, 150E, 200 | Extended Air Tube (Lx100-200) |
| 3 | 83195 | 300–500 | Extended Air Tube (Lx300-500) |
| 3 | 84132 | 600, 700, 800 | Conical Air-Gas Inlet Pipe / Stabilor (Lx600-800) |
| 4 | 82766 | 150–500 | Blower Gasket (Lx150-500) |
| 4 | 84026 | 600–800 | Blower Gasket (Lx600-800) |
| 5 | 82052 | 150 | EBM Blower RG130 (Lx100-150, not Lx150E) |
| 5 | 82661 | 150E, 200, 300 | EBM Blower RG148/1200-3633 (Lx150E-300) |
| 5 | 82994 | 400 | EBM Blower RG148/Enhanced (Lx400) |
| 5 | 84322 | 500 | EBM Blower NRG137 (Lx500) |
| 5 | 84006 | 600–800 | EBM Blower G1G170 (Lx600-800) |
| 6 | 82054-2 | 150, 150E, 200, 300 | CVI Venturi Gasket (Lx150-300) |
| 6 | 83106 | 400 | O-ring, Venturi to Blower (Lx400) |
| 6 | 84084 | 600–800 | O-ring, Venturi to Blower (Lx600-800) |
| 7 | 82054-1 | 150, 150E, 200 | CVI Venturi 01 (Lx150-200) |

| Item | Part # | Models | Description |
|---|---|---|---|
| 7 | 81994 | 300 | CVI Venturi 51 (Lx300) |
| 7 | 82990 | 400 | CVI Venturi (Lx400) |
| 7 | 84013 | 600–800 | CVI Venturi (Lx600-800) |
| 8 | 82650 | 150, 150E, 200 | CVI 5.20mm Orifice, LP (Lx150-200) |
| 8 | 84157 | 300 | CVI 6.20mm Orifice, LP (Lx300) |
| 8 | 82993 | 400 (NG) | Gas Valve Orifice, 8.0mm, NG (Lx400) |
| 8 | 83017 | 400 (LP) | Gas Valve Orifice, 6.2mm, LP (Lx400) |
| 9 | 82054 | 150–300 | Gas Valve (CVI) VK8115F1134B (Valve Only) (Lx150-300) |
| 9 | 82989 | 400 | Gas Valve VR8615VB 1044B (Lx400) |
| 9 | 84318 | 500 | Gas Valve GB-ND 057 (Lx500) |
| 9 | 84012 | 600–800 | Gas Valve V8730C 1023B (Lx600-800) |
| 10 | 83870 | 150–500 | Ignition Electrode, Dual – c/w gasket (Lx150-500), gap = 3/16 to 1/4 inch |
| 10 | 84154 | 600–800 | Ignition Electrode, Dual (Lx600-800), gap = 3/16 to 1/4 inch |
| 11 | 82774 | All Models | Flame Probe Gasket (Lx Series) |
| 12 | 82600 | 150, 150E, 200, 300 | Gas Valve Regulator Vent Adapter (Lx150-300) |
| 13 | 83883 | 150, 150E, 200, 300 | CVI Gas Valve Inlet O-ring Gasket (Lx150-300) |
| 13 | 83194 | 400 | Gas Valve Connector O-ring, Large (Lx400) |
| 13 | 84138 | 600–800 | Gas Valve Inlet O-ring (Lx600-800) |
| 14 | 82065 | 150, 150E, 200, 300 | Gas Valve (CV1) 1/2" NPT elbow #45.900.400-132B (Lx150-300) |
| 14 | 82991 | 400 | Gas Valve Adapter 45900400-138B, 3/4" NPT (Lx400) |
| 14 | 84321 | 500 | Gas Valve Adapter 253-517, 3/4” NPT, c/w screws and O-ring (Lx500) |
| 14 | 84035 | 600–800 | Gas Valve Adapter, 1" NPT (Lx600-800) |
| 15 | 83606 | All Models | Outlet Sensor, Dual (Lx Series) |
| 16 | 83223-1 | 150, 150E, 200, 300, 400 | Low Water Pressure Switch, 1/4" NPT (Lx150-400) |
| 17 | 83462 | 150, 150E, 200 | Street Tee, Brass, 1/4" (Lx150-200) |
| 17 | 82698 | 300, 400 | 1/4" NPT Brass Tee (Lx300-400) |
| 18 | 83007 | All Models | 1/4"x 1/8" Bushing Brass (Lx Series) |
| 19 | 82539 | All Models | Automatic Air Vent 1/8" (Lx Series) |
| 20 | 83608 | 150, 150E, 200, 300, 400 | Flue Sensor, Dual (Lx150-400) |
| 20 | 84039 | 500–800 | Flue Sensor, Dual (Lx Commercial) |
| 21 | 82765 | 150, 150E, 200 | Composite Flue Outlet Gasket (Lx150-200) |
| 22 | 82763 | 150, 150E, 200 | Composite Flue Box (Lx150-200) |
| 23 | 82764 | 150, 150E, 200 | Trinity Flue Box to Heat Exchanger Gasket (Lx150-200) |
| 24 | 83605 | All Models | Inlet Sensor, Single (Lx Series) |
| 25 | 83706 | 150, 150E, 200, 300, 400 | Plug, Brass, 1/4" NPT (Lx150-400) |
| 25 | 84075 | 500–800 | Plug, Brass, 1/2" NPT (Lx Commercial) |
| 26 | 83395 | 150 (CAN) | Heat Exchanger (CAN - Lx100-150, not Lx150E) – Canada Only |
| 26 | 83012 | 150 (US) | Heat Exchanger-ASME (US - Lx100-150, not Lx150E) – US Only |
| 26 | 83396 | 150E, 200 | Heat Exchanger-ASME (Lx150E-200) |
| 26 | 84022 | 300 | Heat Exchanger-ASME (Lx300) |
| 26 | 82926 | 400 | Heat Exchanger-ASME (Lx400) |
| 26 | 86217 | 500 | Heat Exchanger-ASME (Lx500) |
| 26 | 84312 | 600 | Heat Exchanger-ASME (Lx600) |
| 26 | 86219 | 700, 800 | Heat Exchanger-ASME (Lx700-800) |
| 27 | 83042 | 150, 150E, 200 | Y-Drain Fitting 5/8", White (Lx150-200) |
| 28 | 83721 | All Models | Tee, PVC, 1/2", Sch.40, White (Lx Series) |
| 29 | 83720 | All Models | Elbow, Street, PVC, 1/2", Sch.40, White (Lx Series) |
| 30 | 83715 | 150, 150E, 200 | Condensate Drain Tube (Lx150-200) |
| 30 | 83907 | 300, 400 | Condensate Drain Tube (Lx300-400) |
| 30 | 84313 | 500, 600 | Condensate Drain Tube (Lx500-600) |

| Item | Part # | Models | Description |
|---|---|---|---|
| 30 | 83996 | 700, 800 | Condensate Drain Tube (Lx700-800) |
| 31 | 83112 | All Models | Trinity Divider Plate Insulation c/w Washer & Screw (Lx Series) |
| 32 | 82770 | 150–500 | Burner Door Viton Gasket (Lx150-500) |
| 32 | 84136 | 600–800 | Burner Door Viton Gasket (Lx600-800) |
| 33 | 83808 | 150, 150E, 200, 500 | Burner Door Ceramic Disc (Lx150-200,500) |
| 33 | 83950 | 300, 400 | Burner Door Ceramic Disc (Lx300-400) |
| 33 | 84137 | 600–800 | Burner Door Ceramic Disc (Lx600-800) |
| 34 | 83885 | 150, 150E, 200, 500 | Cast Alum Burner Door (Lx150-200,500) |
| 34 | 83949 (85053) | 300, 400 | Cast Alum Burner Door (Lx300-400) |
| 34 | 84135 | 600–800 | Cast Alum Burner Door (Lx600-800) |
| 35 | 83934 | 300, 400 | Nipple, 1/4" x 6", Brass 113-B6 (Lx300-400) |
| 36 | 82762 | 150–500 | Flame Rod (Lx150-500) |
| 36 | 84155 | 600–800 | Flame Rod (Lx600-800) |
| 37 | 82099 | 150, 150E, 200, 300 | 1-1/2" MJ Coupling (Lx150-300) |
| 37 | 83951 | 400 | 2" Gear Clamp Assembly (Lx400) |
| 38 | 83425 | 150, 150E, 200 | Elbow, Street 90, PVC Sys 15,1-1/2" (Lx150-200) |
| 39 | 83426-1 | 150 (US) | 1-1/2" PVC Pipe, Sys 15, 1.75" Long (Lx150 US) |
| 39 | 83426-2 | 150E, 200 | 1-1/2" PVC Pipe, Sys 15, 4.5" Long (Lx150E-200) |
| 39(a) | 84208 | 300 | 1-1/2" Air Metering Assembly (Lx300) |
| 39(b) | 84209 | 300 | 2” PVC Air Inlet Assembly (Lx300) |
| 39 | 83952 | 400 | Air Inlet Assembly (Lx400) |
| 40 | 83425-1 | 150, 150E, 200 | Air Metering Elbow (Lx150-200) |
| 41 | 83712 | 150, 150E, 200 | Flue Outlet Adapter (Trinity Lx 3” PVC), c/w plug (Lx150-200) |
| 41 | 84387-1 | 300-600 | Flue Outlet Adapter c/w Tabs (Lx300-600) |
| 41 | 84052 | 700, 800 | Flue Outlet Adapter (Lx700-800) |
| 42 | 82882 | 300, 400 | Coupling, Rubber , 4", Fernco (Lx300-400) |
| 42 | 84051 | 500–800 | Air Inlet Adapter SS (Lx Commercial) |
| 43 | 83477 | 150, 150E, 200 | Bushing, PVC Sch. 40, 3"x1.5" (Lx150-200) |
| 44 | 83712-1 | 150, 150E, 200 | 3/8" Stainless Steel Plug (Lx150-200) |
| 44 | 84497 | 300-600 | Exhaust Test Plug (Lx300-600) |
| 44 | 84054 | 700–800 | Exhaust Test Plug (Lx700-800) |
| 45 | 83873 | 150, 150E, 200 | TiS Wall Mount Bracket 2 (Lx150-200) |
| 45 | 83953 | 300, 400 | Wall Mounting Clip (Lx300-400) |
| 46 | 83505 | 150, 150E, 200, 300 | Grommet, Vinyl, 1/2" IPS (Lx150-300) |
| 46 | 83923 | 400 | Grommet, Vinyl, 3/4" IPS (Lx400) |
| 46 | 83506 | 600–800 | Grommet, Vinyl, 1" IPS (1030) (Lx600-800) |
| 47 | 83506 | 150, 150E, 200 | Grommet, Vinyl, 1-3/8" OD |
| 47 | 83924 | 300, 400 | Grommet, Vinyl, 2" OD (Lx300-400) |
| 47 | 84097 | 500–800 | Grommet, Vinyl, 2 1/2" IPS (3125) (Lx Commercial) |
| 48 | 83874 | 150, 150E, 200 | TiS Air Switch Support Clip II (Lx150-200) |
| 48 | 83954 | 300, 400 | Air Switch Bracket (Lx300-400) |
| 48 | 84139 | 600–800 | Air Switch Bracket (Lx600-800) |
| 49 | 82662 | All Models | Air Switch Huba 604.E021180 set @ .15" w.c. (Lx Series) |
| 50 | 83875 | 150, 150E, 200 | TiS Wall Stand-Off - Bottom (Lx150-200) |
| 50 | 83955 | 300, 400 | Wall Mounting Support, Bottom (Lx300-400) |
| 51 | 83508 | All Models (pre 6/1/12) | Display Molding (Models manufactured before June 1, 2012) |
| 51 | 84622 | All Models (post 6/1/12) | Display Molding (Models manufactured after June 1, 2012) |
| 52 | 83592 | 200 (pre 6/1/12) | Display S7999C, White (Lx200 manufactured before June 1, 2012) |
| 52 | 83592-Lx | 150, 300-800 (pre 6/1/12) | Display Upgrade kit (Models manufactured before June 1, 2012) |
| 52 | 84653 | All Models (post 6/1/12) | Display S7999D, Black (Models manufactured after June 1, 2012) |

| Item | Part # | Models | Description |
|---|---|---|---|
| 53 | 83876 | 150, 150E, 200 | Electrical J-box Cover R1, Left (Lx100-200) |
| 54 | 83872 | All Models | Barrier Strip, Line Voltage (Lx Series) |
| 55 | 83877 | 150, 150E, 200 | Electrical J-box, Line Voltage (Lx150-200) |
| 56 | 83707 | All Models | Ignition Coil Q652B1006/B (Lx Series) |
| 57 | 83724 | All Models | Spark Igniter Wire, 12" (Lx Series) |
| 58 | 82250 | All Models | SNAP BUSHING, 1" (Lx Series) |
| 59 | 83592-1 | All Models | Power Supply – Touch Screen (Lx Series) |
| 60 | 83190 | 150, 150E, 200, 300, 400 | Transformer, 24V, 40VA (Lx150-400) |
| 60 | 84047 | 500–800 | Transformer, 24V, 75VA (Lx Commercial) |
| 61 | 83589 | 150, 150E, 200, 300, 400 | ICP Honeywell Sola Controller R7910B1015/B (Lx150-400) |
| 61 | 84034 | 500–800 | ICP Honeywell Sola Controller R7910A1001 (Lx Commercial) |
| 62 | 83878 | 150, 150E, 200, 300, 400 | Drawer Cover (Lx150-400) |
| 62 | 84140 | 500–800 | Control Panel Cover (Lx Commercial) |
| 63 | 83879 | 150, 150E, 200, 300, 400 | Drawer (Lx150-400) |
| 63 | 84141 | 500–800 | Control Panel (Lx Commercial) |
| 64 | 83880 | 150, 150E, 200 | Electrical J-box, Low Voltage (Lx150-200) |
| 65 | 83871 | 150, 150E, 200, 300, 400 | Barrier Strip, Low Voltage (Lx150-400) |
| 65 | 84065 | 500–800 | Barrier Strip, Low Voltage (Lx Commercial) |
| 66 | 83876-1 | 150, 150E, 200 | Lx150-200 Electrical J-box Cover R1 (Right) (Lx150-200) |
| 67 | 83517 | 150, 150E, 200, 300, 400 | Fuse, Matrix/Lx, 2 Amp (Lx150-400) |
| 68 | 84192 | All Models | Fuse Holder, 20 Amp at 250VAC Max (Lx Series) |
| 69 | 83837 | All Models | Fuse, Littlefuse 7A, 250VAC, Fast Blow (Lx Series) |
| 70 | 83882 | All Models | Touch Screen Display Support (Lx Series) |
| 71 | 81027-1 | All Models | Outdoor Sensor, 10K (Lx Series) |
| 72 | 83886 | 150, 150E, 200 | Front Cover (Lx150-200) |
| 72 | 83956 | 300, 400 | Front Cover (Lx300-400) |
| 72 | 84372 | 500 | Front Cover (Lx500) |
| 72 | 84142 | 600–800 | Front Cover (Lx600-800) |
| 73 | 83887 | 150, 150E, 200 | Right Side (Lx150-200) |
| 73 | 84210 | 300 | Right Side (Lx300) |
| 73 | 83957 | 400 | Right Side R1 (Lx400) |
| 73 | 84373 | 500 | Right Side (Lx500) |
| 73 | 84374 | 600 | Right Side (Lx600) |
| 73 | 84143 | 700, 800 | Right Side (Lx800) |
| 74 | 83888 | 150 (CAN) | Left Side (Lx150 CAN) |
| 74 | 83888-1 | 150 (US) | Left Side (Lx150 US, not 150E) |
| 74 | 83888-2 | 150E, 200 | Left Side (Lx150E-200) |
| 74 | 84211 | 300 | Left Side (Lx300) |
| 74 | 83958 | 400 | Left Side (Lx400) |
| 74 | 84375 | 500 | Left Side (Lx500) |
| 74 | 84376 | 600 | Left Side (Lx600) |
| 74 | 84144 | 700, 800 | Left Side (Lx700-800) |
| 75 | 83889 | 150, 150E, 200 | Front Top (Lx150-200) |
| 75 | 84212 | 300 | Front Top (Lx300) |
| 75 | 82959 | 400 | Front Top (Lx400) |
| 75 | 84377 | 500 | Top (Lx500) |
| 75 | 84378 | 600 | Top (Lx600) |
| 75 | 84145 | 700, 800 | Front Top (Lx700-800) |
| 76 | 83890 | 150, 150E, 200 | Top Panel Back R1 (Lx150-200) |
| 76 | 83960 | 300, 400 | Rear Top (Lx300-400) |

| Item | Part # | Models | Description |
|---|---|---|---|
| 76 | 84146 | 700, 800 | Rear Top (Lx700-800) |
| 77 | 83961 | 300, 400 | Fuel-Air Metallic Tubing with Ends (Lx400) |
| 77 | 84379 | 500 | Fuel-Air Metallic Tubing with Ends (Lx500) |
| 77 | 84147 | 600–800 | Fuel-Air Metallic Tubing with Ends (Lx600-800) |
| 78 | 83915 | 300, 400 | High-Vent Pressure Switch, AFS460-367 (Lx300-400) |
| 78 | 84380 | 500 | High -Vent Pressure Switch, ANA124-406 (Lx500) |
| 78 | 84053 | 600–800 | High -Vent Pressure Switch, ANA124-381 (Lx600-800) |
| 79 | 83962 | 400 | Gas Valve Orifice O-ring, Large (Lx400) |
| 80 | 84057 | 500–800 | Coupling, 2”, Brass (Lx Commercial) |
| 81 | 84010 | All Models | System Sensor, Pipe Sensor TSA00A4 (Lx Series) |
| 82 | 84087 | 600–800 | Gasket, Cork (Lx600-800) |
| 83 | 84045 | 600–800 | Cross, Brass, M5 Thread To Barb (Lx600-800) |
| 84 | 84148 | 600–800 | Air Metering Tube (Lx600-800) |
| 85 | 84044 | 600–800 | Elbow, Brass, M5 to Barb (Lx600-800) |
| 86 | 84388 | 500 | Nipple, 3/4" x 5", Black Iron (Lx500) |
| 86 | 84061 | 700, 800 | Nipple, 1" x 6", Black Iron (Lx700-800) |
| 87 | 84389 | 500 | Elbow, 3/4", 90 deg., Street, Black Iron (Lx500) |
| 87 | 84063 | 600–800 | Elbow, 1", 90 deg., Street, Black Iron (Lx600-800) |
| 88 | 84347 | 500 | Manual Shutoff Valve, 3/4" NPT (Lx500) |
| 88 | 84025 | 600–800 | Manual Shutoff Valve, 1" NPT (Lx600-800) |
| 89 | 84390 | 500 | Nipple, 3/4" x 2-1/2", Black Iron (Lx500) |
| 89 | 84351 | 600 | Nipple, 1" x Close, Black Iron (Lx600) |
| 89 | 84062 | 700, 800 | Nipple, 1" x 3-1/2", Black Iron (Lx700-800) |
| 90 | 84064 | 700, 800 | Elbow, 1", 90 deg., Black Iron (Lx700-800) |
| 91 | 84102 | 500–800 | Flow switch, FS8-W, Paddles – 2-1/2” (Lx Commercial) |
| 92 | 84099 | 500–800 | Bushing, 2" x 1", Brass (Lx Commercial) |
| 93 | 84058 | 500–800 | Tee, 2" x 2" x 2", Brass (Lx Commercial) |
| 94 | 84381 | 600 | Gas Valve Regulator Sensing Tube (Lx600) |
| 94 | 84149 | 700, 800 | Gas Valve Regulator Sensing Tube (Lx700-800) |
| 95 | 84095 | 500–800 | Plug, 7/8" Black Dome (Lx Commercial) |
| 96 | 84069 | 600–800 | Clamp, U-bolt, 1" IPS (Lx600-800) |
| 97 | 84072 | 500–800 | Leg Leveler, 3/8-16 x 1/5" (Lx Commercial) |
| 98 | 84073 | 500–800 | Leg Leveler Hex Base Cap (Lx Commercial) |
| 99 | 84150 | 500–800 | Flow Switch Wiring Conduit (Lx Commercial) |
| 100 | 83923 | 500–800 | Grommet, Vinyl, 3/4" IPS (1020) (Lx Commercial) |
| 101 | 84346 | 500 | Grommet, Vinyl (3375), Air-inlet (Lx500) |
| 101 | 84011 | 600–800 | Gasket, Air-inlet 3/16" (Lx600-800) |
| 102 | 84056 | 500–800 | Relay, Omron (Lx Commercial) |
| 103 | 84043 | 500–800 | Rocker Switch, Black (Lx Commercial) |
| 104 | 84130 | 500–800 | Flow Switch Wiring Conduit Fitting (Lx Commercial) |
| 105 | 82064 | 150-300 | Gas Valve Harness, CVI (Lx150-300) |
| 105 | 83016 | 400 | Gas Valve Harness (Lx400) |
| 105 | 84319 | 500 | Gas Valve Harness, Dungs (Lx500) |
| 106 | 84392 | 300–800 | Thermal Fuse, Heat Exchanger Exterior (Lx300-800) |
| 114 | 84993 | 300-800 | M5 Reset Safety Switch (Lx300-800) |

## 17.0 TROUBLESHOOTING

**⚠ WARNING** Observe the following precautions when servicing the water heater. Failure to comply with these may result in fire, property damage, serious injury or death.

### Servicing the Water heater

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

These procedures should only be performed by qualified service personnel when abnormal operation of the water heater is suspected. The water heater incorporates a sophisticated microprocessor-based control which normally responds appropriately to varying conditions. If the water heater operation appears to be incorrect, or it is not responding at all to a demand for heat, the following is suggested to determine and correct the problem.

**NOTICE** Before undertaking any troubleshooting procedures, it is highly recommended to have available a digital multimeter(s) capable of measuring AC and DC volts, Amperes, Resistance (ohms) and Continuity.

### Check 120VAC and 24VAC at the Water heater

First, verify the following:

- There is 120V being supplied to the water heater:
  - The circuit breaker in the electrical panel supplying power to the water heater is not tripped.
  - The service switch (if applicable) is in the ON position.
- There is a heat call from the thermostat:
  - Verify 24VAC to thermostat.
  - The thermostat is placed at a sufficiently high setting to create a call for heat to the water heater.

To check for the presence of 120VAC and 24VAC at the water heater follow this procedure:

- Remove the water heater front cover.
- 120VAC
  - Remove the Line Voltage junction box cover. First remove the #10 pan-head Phillips screw securing the cover to the junction box. Lift the cover to release it from the water heater base and withdraw the cover from the water heater cabinet. This will expose the Line Voltage barrier strip.
  - With an AC voltmeter set on the appropriate scale, measure the voltage across the L1 and L2 terminals (terminals 1 and 5).
  - If 120VAC is not detected, check the electrical service as suggested above. If the service is verified, inspect the circuit wiring from the panel to the water heater for broken or disconnected conductors.
- 24VAC (only check if 120VAC supply is verified).
  - Remove the Low Voltage junction box cover. First remove the #10 pan-head Phillips screw securing the cover to the junction box. Lift the cover to release it from the water heater base and withdraw the cover from the water heater cabinet. This will expose the Low Voltage barrier strip.
  - With an AC voltmeter set on the appropriate scale, measure the voltage across the R and C terminals (terminals 3 and 1).
  - If 24VAC is not detected, check Fuse "C" (see below).

**Figure 17-1(a) Lx200WH-Lx400WH**

**Control Panel Fuse Locations**

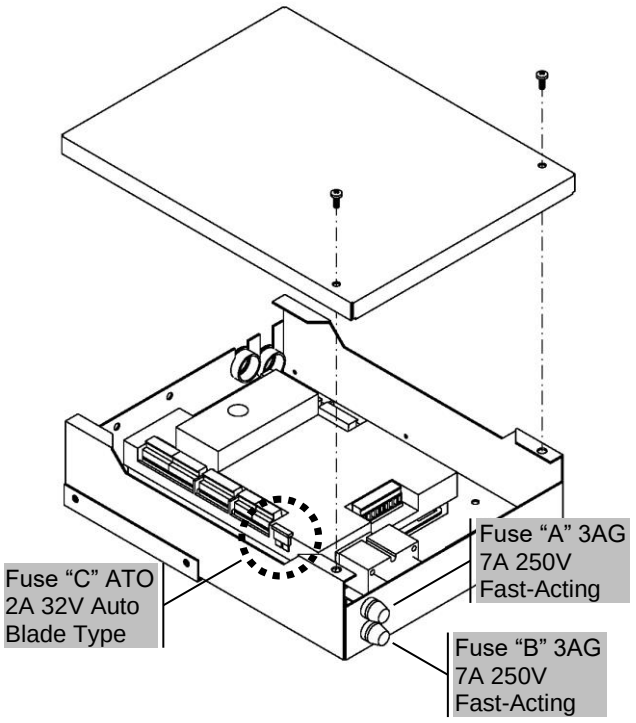
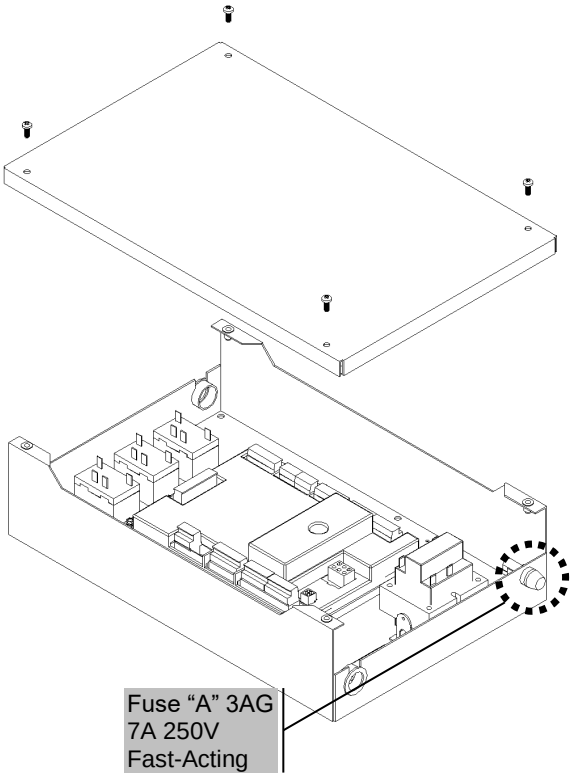



**Figure 17-1(b) Lx500WH-Lx800WH**

**Control Panel Fuse Location**




## Fuses

There are three (3) fuses associated with the Trinity Lx200WH-Lx400WH controller but only one (1) with the Lx500WH-Lx800WH controller. Check these fuses before replacing the controller or any other electrical component; if the fuse is blown, it will prevent the protected device(s) from functioning.

To check, and if necessary, replace the fuses:

- Remove all 120VAC power from the water heater. Be careful to check that the unit is not powered from more than one source e.g., a UPS (uninterruptible power supply).
- Remove the front cover.
- On models Lx200WH-Lx400WH the control panel is located below the heat exchanger. Fuses "A" and "B" are accessible by removing the spring-loaded knurled knob of their respective holders. Push the knob toward the panel, and twist approximately 1/4 turn counterclockwise.
- To access Fuse "C", remove the two #10 pan-head Phillips screws and lift the top cover from the panel. The auto blade type fuse is installed in an "inline" style fuse holder.
- On models Lx500WH-Lx800WH, the control panel is located above the heat exchanger toward the back of the unit. Fuse "A" is accessible by removing the spring-loaded knurled knob from its holder. Push the knob toward the panel, and twist approximately 1/4 turn counterclockwise.

After inspecting and if necessary, replacing fuses, replace the panel cover and front cover. Restore power to the water heater and confirm proper operation.

**⚠ WARNING** Only replace fuses with identical parts, see Figures 17-1(a) and (b). Failure to follow this warning may result in component failure, fire, property damage, serious injury or death.

## User Interface (Touch-screen Display)

A blank screen does not necessarily indicate a problem; the display may be configured to automatically blank the screen after a pre-set interval. Simply touch the screen to activate it. Confirm that 120V power is being supplied to the water heater. If the screen does not become active, perform the following procedure:

### Blank Screen

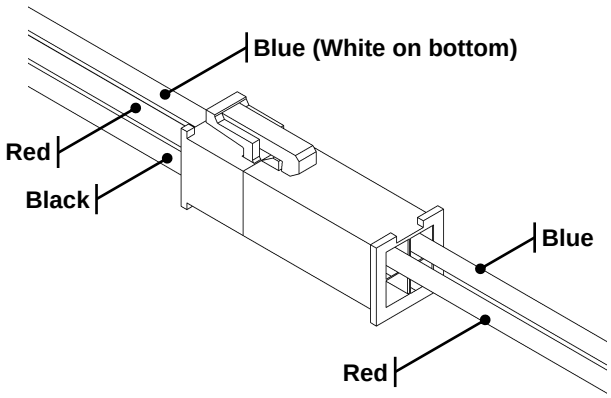
1. Remove the front cover from the water heater.
2. Remove the control panel cover and check Fuse "C" (Auto Blade Type); if faulty check for shorts in the thermostat wiring, correct, then replace fuse (see Figure 17-1).
3. Ensure the "2 by 2" Molex connector, located behind the display at the top, is connected and that the wires are fully inserted (see Figure 17-2). Verify that 24VAC is present between the Blue and Red wires; if not trace wiring back to 24VAC transformer; correct wiring and/or replace transformer [see applicable Figure 13-1(a) or 13-1(b)].
4. Remove the display assembly from the control panel and check the 24VAC wiring connection on the back of the display; Blue to terminal 7 [24VAC (COM)], Red to terminal 8 [24VAC].

### System Disconnected

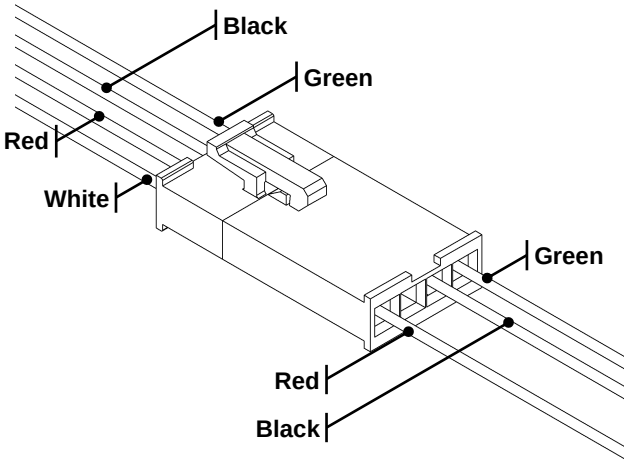
If the Touch-screen Display is not blank but is displaying "System Disconnected!" in the middle of the screen, ensure the 4 by 1 Molex connector, located behind the display at the top, is connected and that the wires are fully inserted (see Figure 17-2). If the connector appears to be fine, check the wiring connections on the back of the touch-screen display; Green, Red and Black go to terminals 1, 2 and 3 respectfully.

**Figure 17-2 Touch-screen Display Electrical Disconnects**

**Power Supply Connector (2 by 2)**




**Communication Connector (4 by 1)**




**CAUTION** DO NOT drop the plastic housing or allow it to swing down freely, it may be damaged by forceful impact.

**Summary and Diagnostics Display –** The Trinity Lx controller and Touchscreen display provides detailed operational and diagnostic information for aid in troubleshooting. When power is applied to the water heater the initial page displayed is the Summary page. Information presented on the Summary page includes Demand source, Burner state, status of sensors and pumps, and so forth. Any current Alert or Lockout condition is also displayed. Accessible from the Summary page are the Diagnostics pages. Refer to the controller manual for more information.

**Lockout and Alert History** – The controller maintains a record of the fifteen (15) most recent events for both Lockouts and Alerts. To display the logs, touch the History button on the Summary page (refer to Section 7.0 in ***Appendix A - Controller and Touchscreen Display Instructions***). In any situation where malfunction is suspected, always check the Alerts and Lockouts history. Entries recorded in the history provide useful information for determining the cause of the malfunction.

**Table 17-1 Troubleshooting Chart**

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| Display shows "System Disconnected" constantly | Communication wire disconnected | See, "System Disconnected!" above. |
| | Faulty Sola controller | If 24VAC present at controller terminals J8 1 & 2, check Power LED on controller. Verify that connector J8 is securely plugged into the controller. Recycle power to water heater, if controller does not operate, replace the controller. |
| Burner not operating | Heat demand satisfied; no call for heat | Check Demand and Set points via Touchscreen. Check thermostat and DHW aquastat (if applicable) setting. |
| | Water heater outlet temperature exceeds "Setpoint - On Hysteresis" | Check outlet temperature, setpoint and hysteresis settings via Touchscreen. |
| | Hold delay or Lockout | Check Summary page on Touchscreen for code. |
| | Burner switch off | Check Summary page, if Demand indicates "Burner switch off" go to diagnostics burner test page and switch on. |
| Lockout 2 – Waiting for safety data verification | Safety parameter(s) has been adjusted | Changing settings that are considered safety parameters require "Safety data verification". Refer to Appendix A. |
| Lockout 9 – Flame bias out of range | 4-20mA input being overdriven. | If using 4-20mA input, check to ensure current is not greater than 21mA. |
| | Control malfunction | Cycle power, if problem returns replace control. |
| Hold 27 – Flame rod shorted to ground detected | A flame circuit shorted to ground may show up as a flame circuit timeout. Zero-ohm shorts can display as Hold 27. | Check to ensure condensate drain is not blocked. Check to ensure no voltage applied to R & T terminals. If using 4-20mA input, check to ensure current is not greater than 21mA. |
| Hold 61 – Anti short-cycle | Demand off | Check demand. Delay is to prevent rapid cycling of burner. |
| Hold 62 – Fan speed not proved | Normal Operation (Drive to Lightoff) | Hold 62 is momentarily displayed prior to burner ignition during the Drive to Lightoff. |
| | Blown fuse | Check Fuse "A", blown fuse prevents blower from operating. |
| | Wiring defect | Inspect blower wiring, ensure connectors at Sola controller and blower are securely attached. |
| | - Faulty Sola controller<br>- Faulty Blower | If Hold 62 persists for 15 seconds or more, while the blower is running, check "Fan speed" indicated on display. If "LOW RPM", "HIGH RPM", "0" or rapidly changing RPM value is displayed, try connecting another Sola controller. If problem remains, replace blower. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| Hold 63 – LCI OFF (Limit control input) | Replacement control incorrectly configured. | LCI must be set to "enable" on all Lx models, excluding Lx150/150E units with a serial number of 49351 or lower and Lx200/400 units with a serial number of 48251 or lower. See instructions included with replacement controller. |
| Lockout or Hold 65 – Interrupted Air Switch OFF | No problem, normal operation | Hold 65 will normally be displayed momentarily during the drive to light-off. |
| | Blown fuse | Check Fuse "A", blown fuse prevents blower from operating. |
| | Faulty blower | If Fuse "A" is good and blower remains off, check 120VAC supply to blower, if present replace blower. If blower is on proceed to next step. |
| | Blocked venting | Check for blockage of the exhaust vent. |
| | Blocked air inlet | Check for blockage of the air inlet. |
| | Disconnected, damaged or blocked tubing | Inspect the clear vinyl tubing connecting the air switch + and – ports to the air metering elbow. Condensation or other foreign matter may be obstructing the tubing, preventing the switch from sensing differential pressure caused by air flow through the metering elbow. |
| | Incorrect air switch setting | Contact NTI technical support. |
| | Faulty air proving switch | If venting and air inlet are clear, temporarily jumper the air switch. If the unit lights and operates smoothly – replace air switch. If the unit fails to light or lights but runs rough or abruptly shuts down – check water heater internals for blockage.<br>**WARNING** Only jumper the air switch for diagnosing purposes. |
| | Tripped High Vent Pressure Switch (Lx300-400 only) | The high vent pressure switch will trip when the combustion chamber is blocked. Clean combustion chamber and reset switch. |
| | Tripped Thermal Fuse (Lx300-400 only) | Check Thermal Fuse on the back of the heat exchanger (accessed from the rear of the cabinet). If tripped contact NTI. |
| | Tripped Door Reset Safety Switch (Lx300-800 only) | The Door Reset Safety Switch will trip with the combustion chamber gets dirty or the door insulation fails. Clean the combustion chamber, inspect the door insulation and reset the switch. |
| | Incorrect air switch wiring | Check that the red and orange wires are connected to quick connect tabs 3 and 1 respectively. |
| Hold 66 – Interrupted air switch ON (and blower is off) | Incorrect air switch setting | Contact NTI technical support. |
| | Incorrect air switch wiring | Check that the red and orange wires are connected to quick connect tabs 3 and 1 respectively. |
| | Faulty air switch | Disconnect red and orange wires from air switch and check for open circuit between terminals 1 & 3. If continuity detected, replace air switch. |
| Hold 66 – Interrupted air switch ON (and blower is on) | - Blower problem<br>- Faulty controller | Check low voltage wiring from blower to controller. Check VDC signal from red–green and black-green; if not 28-32VDC and 0 VDC respectfully – replace controller. If signal is correct – replace blower. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| Lockout or Hold 67 – ILK OFF | Insufficient water pressure (Lx150-400 only) | Ensure at least 15PSI at water heater outlet. Refer to Supplementary Documentation section 2.0 System Piping. |
| | External Limit Tripped | Indication that an external limit (wired to "LIM") is open. Not a problem with water heater, check external limit. |
| | Insufficient flow for Flow Switch (Lx500-800 only) | Check plumbing, ensure circulator is operating. |
| | Tripped Thermal Fuse (Lx500-800 only) | Check Thermal Fuse on the back of the heat exchanger (accessed from the rear of the cabinet). If tripped contact NTI. |
| | Tripped High Vent Pressure Switch (Lx500-800 only) | The high vent pressure switch will trip when the combustion chamber is blocked or venting is too restrictive. Check venting and clean combustion chamber. |
| Lockout or Hold 79 – Outlet High Limit | CH or DHW settings | Check if CH and/or DHW setpoint temperature plus off hysteresis exceed "High limit" setpoint – factory setting = 210°F (99°C). |
| | CH or DHW pump problem | See "Inoperative CH or DHW pump" below. |
| | Incorrect "Outlet high limit" setting | Increase "Outlet high limit" setting; maximum setting = 210°F (99°C). |
| Lockout or Hold 81 – Delta T limit<br>OR<br>Water heater making banging or hissing sounds | Insufficient water flow | • Check Fuse "A"<br>• Check water heater pump.<br>• Ensure plumbing is correct. Refer to Supplementary Documentation section 2.0 System Piping. Check that water pressure is at least 15PSI.<br>• **Water heaters Only** - Water heater heat transfer surfaces may be fouled with scale or magnetite. Clean with Fernox DS-40 Descaler and Cleanser. See Table 10-1. |
| Lockout 82 – Stack limit | Dirty heat exchanger | Inspect and if required clean the combustion chamber and/or heat exchanger. Refer to 14.0 Annual Maintenance and Inspection and Supplementary Documentation section 2.0 System Piping. |
| | Incorrect "Stack limit setpoint" | Unless installed in Canada with PVC exhaust venting, set "Stack limit setpoint" to maximum setting of 220ºF (104ºC). In Canada PVC exhaust venting is limited to 149ºF (65ºC). |
| | Faulty sensor | Check resistance of stack sensor and compare to thermistor resistance chart, see Table 17-2. |
| Lockout or Hold 85 – Inlet/Outlet Inversion Limit | Pump flowing in the wrong direction | Ensure water circulation is flowing into the water heater at the fitting closest to the wall. |
| | Incorrect factory sensor wiring | Disconnect flue sensor cable; screen should display "Hold 95 – Stack sensor fault"; if not contact NTI. |
| Lockout or Hold 88 – Outlet T Rise limit | Insufficient water flow | See Lockout or Hold 81. |
| Hold 91– Inlet sensor fault | Sensor disconnected | • Verify that 2-position Molex connector on wiring harness is securely attached to mating connector on inlet sensor.<br>• Inspect sensor wiring. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| | Faulty sensor | Check resistance of sensor and compare to thermistor resistance chart, see Table 17-2. |
| Hold 92 – Outlet sensor fault | Sensor disconnected | • Verify that 4-position Molex connector on wiring harness is securely attached to mating connector on outlet sensor.<br>• Inspect sensor wiring. |
| | Faulty sensor | Check resistance of sensor and compare to thermistor resistance chart, see Table 17-2. |
| Hold 95 – Stack sensor fault | Sensor disconnected | • Verify that 4-position Molex connector on wiring harness is securely attached to mating connector on stack sensor.<br>• Inspect sensor wiring. |
| | Faulty sensor | Check resistance of sensor and compare to thermistor resistance chart, see Table 17-2. |
| Lockout 109 – Ignition failure occurred (Lx500-800 only)<br><br>Or<br><br>Hold 110 – Ignition failure occurred, failure to prove flame after 3 ignition attempts (Lx150-400 only) | Incorrect spark igniter gap or faulty spark igniter | Check spark igniter gap – gap between electrodes should be 3/16 to 1/4 inch. |
| | Spark cable disconnected | Ensure that the high voltage spark cable is securely connected to the spark generator and the igniter electrode. Check that the green ground wire is securely attached to the ¼" quick connect tab on the igniter electrode. |
| | Insufficient gas line pressure | Ensure the manual gas shutoff valve is open. Refer to manual section 9.0 GAS VALVE AND BURNER SETUP. |
| | Flame rod disconnected | Verify that the flame rod signal wire is securely attached to the flame rod, which is located bottom center of the burner door. |
| | No 120VAC to Spark Generator | Check wiring from controller to spark generator. With an AC voltmeter measure voltage across J5-6 and ground (the controller chassis is connected to the 120VAC supply ground) during trial for ignition. |
| | Faulty Spark Generator | During trial for ignition check for arc on spark electrode via the observation port located next to the spark electrode in the burner door. If the spark generator is receiving 120VAC and no spark is observed, replace the spark generator. |
| | No 24VAC to Gas Valve | Check the wiring harness for loose or interrupted connections of the gas valve wiring. With an AC voltmeter, measure the voltage from controller terminals J5-2 to J4-10. There should be 24VAC present during trial for ignition. |
| | Faulty Gas Valve | The gas valve emits an audible click when it switches on or off. If the controller is providing 24VAC to the gas valve, and the wiring is intact, it should be possible to detect if the valve is responding. |
| Lockout 113 – Flame circuit timeout | A flame circuit shorted to ground may show up as a flame circuit timeout. High resistance shorts can display as Lockout 113. | Check to ensure condensate drain is not blocked. Check to ensure no voltage applied to R & CH terminals. If using 4-20mA input, check to ensure current is not greater than 21mA. |
| Lockout 122 – Lightoff rate proving failed | Blower is not turning on | See "Blower not operating" below. |
| | Missing or incorrect blower feedback signal | See Hold 62 above. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| | Blower is always on | See "Blower operating at high speed while burner is off" below. |
| Alert 128 - Modulation rate was limited due to IAS was open (Air switch open while burner firing) | Blocked venting | Check for blockage of the exhaust vent. |
| | Blocked air inlet | Check for blockage of the air inlet. |
| Lockout 173 - Pilot relay feedback incorrect<br><br>Lockout 174 – Safety relay feedback incorrect | External Electrical Noise | Look for sources of electrical noise, i.e. a large motor or multiple pieces of equipment starting at the same time. |
| | Failing Limit Switch in ILK circuit | Check operation of internal LWCO, and/or external limit (i.e. devise connected between "R" and "LIM"); replace as necessary |
| | Hardware failure of Sola controller | Reset power, If problem persists replace Sola controller. |
| Alert 206 – Lead Lag header temperature was invalid | System Sensor not connected | If desired, install System Sensor and wire to sensor input connections "SYSTEM" and "SENSOR COM". Otherwise ignore Alert 206 |
| Alert 233 – Lead Lag outdoor temperature was invalid | See Alert 248 | |
| Alert 248 – CH outdoor temperature was invalid | Outdoor sensor not connected | The Trinity Lx is factory set with Outdoor Reset enabled. Connect outdoor sensor or disable Outdoor Reset. |
| | Outdoor sensor wiring | Check wiring of outdoor sensor. Wires should connect to Low Voltage barrier terminals 11 & 12. |
| | Faulty sensor | Check sensor. Should be free of ice and snow. Check resistance of sensor and compare to thermistor resistance chart, see Table 17-2. |
| Alert 311 – Run was terminated due to interrupted air flow switch was off | Blocked venting | Check for blockage of the exhaust vent. |
| | Blocked air inlet | Check for blockage of the air inlet. |
| | Disconnected, damaged or blocked tubing | Inspect the clear vinyl tubing connecting the air switch + and – ports to the air metering elbow. Condensation or other foreign matter may be obstructing the tubing, preventing the switch from sensing differential pressure caused by air flow through the metering elbow. |
| | Incorrect air switch setting | Contact NTI technical support. |
| | Blown fuse | Check Fuse "A". |
| Inoperative CH and/or DHW pump | Blown fuse | Check Fuse "B". |
| | Faulty controller | If Fuse "B" not blown, and controller is operating, navigate to pump diagnostic on display. Manually switch pump on, check for 120VAC at pump connection terminal on line voltage barrier strip. If 120VAC not detected, replace controller. |
| | Faulty pump | If 120VAC supplied to pump, and pump does not operate, replace pump. |
| Blower operating at high speed while burner off | Blower signal cable disconnected | • Verify that the 5-position Molex connector on the wiring harness is securely connected to its mating connector on the blower.<br>• Check that the 4-position Molex connector on wiring harness is securely connected to its mating connector on the controller. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| Blower operating at high speed while burner off | No 24VAC to controller | • Check Power LED on controller.<br>• Check Fuse "C".<br>• With an AC voltmeter measure voltage at terminals J8 1 & 2, 24VAC should be present. |
| Blower not operating | Blower power disconnected | Verify that the 3-position Molex connector on the wiring harness is securely connected to its mating connector on the blower. |
| | Blown fuse | Check Fuse "A" using the procedure described above. Fuse "A" protects the blower as well as the ignition spark generator and water heater pump. |
| | Faulty blower | Measure voltage across pins 1 & 2 (black and white wires) of 3-position connector on wiring harness. If 120VAC detected, replace power connector and remove 5-position signal connector. Blower should rotate at high speed. If blower does not rotate, replace blower. |

**Table 17-2 Thermistor Resistance vs. Temperature**

| Temp °F (°C) | Resistance Ohms (Ω) | Temp °F (°C) | Resistance Ohms (Ω) |
|---|---|---|---|
| -22 (-30) | 176,133 | 122 (50) | 3,603 |
| -4 (-20) | 96,761 | 131 (55) | 2,986 |
| 14 (-10) | 55,218 | 140 (60) | 2,488 |
| 32 (0) | 32,650 | 149 (65) | 2,083 |
| 41 (5) | 25,390 | 158 (70) | 1,752 |
| 50 (10) | 19,900 | 167 (75) | 1,481 |
| 59 (15) | 15,710 | 176 (80) | 1,258 |
| 68 (20) | 12,490 | 185 (85) | 1,072 |
| 77 (25) | 10,000 | 194 (90) | 918 |
| 86 (30) | 8,057 | 203 (95) | 789 |
| 95 (35) | 6,531 | 212 (100) | 680 |
| 104 (40) | 5,327 | 230 (110) | 506 |
| 113 (45) | 4,369 | - | - |

**Table 17-3 Hold and Lockout Codes**

| Code | Description | Note |
|---|---|---|
| 0 | None | Hold / No lockout |
| 1 | Unconfigured safety data | Lockout |
| 2 | Waiting for safety data verification | Lockout |
| 3 | Internal fault: Hardware fault | Hold |
| 4 | Internal fault: Safety Relay key feedback error | Hold |
| 5 | Internal fault: Unstable power (DCDC) output | Hold |
| 6 | Internal fault: Invalid processor clock | Hold |
| 7 | Internal fault: Safety relay drive error | Hold |
| 8 | Internal fault: Zero crossing not detected | Hold |
| 9 | Internal fault: Flame bias out of range | Hold |
| 10 | Internal fault: Invalid Burner control state | Lockout |
| 11 | Internal fault: Invalid Burner control state flag | Lockout |
| 12 | Internal fault: Safety relay drive cap short | Hold |
| 13 | Internal fault: PII shorted to ILK | Hold / Lockout |
| 14 | Internal fault: HFS shorted to LCI | Hold / Lockout |

**Table 17-3 Hold and Lockout Codes**

| Code | Description | Note |
|---|---|---|
| 15 | Internal fault: Safety relay test failed due to feedback ON | Lockout |
| 16 | Internal fault: Safety relay test failed due to safety relay OFF | Lockout |
| 17 | Internal fault: Safety relay test failed due to safety relay not OFF | Lockout |
| 18 | Internal fault: Safety relay test failed due to feedback not ON | Lockout |
| 19 | Internal fault: Safety RAM write | Lockout |
| 20 | Internal fault: Flame ripple and overflow | Hold |
| 21 | Internal fault: Flame number of sample mismatch | Hold |
| 22 | Internal fault: Flame bias out of range | Hold |
| 23 | Internal fault: Bias changed since heating cycle starts | Hold |
| 24 | Internal fault: Spark voltage stuck low or high | Hold |
| 25 | Internal fault: Spark voltage changed too much during flame sensing time | Hold |
| 26 | Internal fault: Static flame ripple | Hold |
| 27 | Internal fault: Flame rod shorted to ground detected | Hold |
| 28 | Internal fault: A/D linearity test fails | Hold |
| 29 | Internal fault: Flame bias cannot be set in range | Hold |
| 30 | Internal fault: Flame bias shorted to adjacent pin | Hold |
| 31 | Internal fault: SLO electronics unknown error | Hold |
| 32 | Internal fault: Safety Key 0 | Lockout |
| 33 | Internal fault: Safety Key 1 | Lockout |
| 34 | Internal fault: Safety Key 2 | Lockout |
| 35 | Internal fault: Safety Key 3 | Lockout |
| 36 | Internal fault: Safety Key 4 | Lockout |
| 37 | Internal fault: Safety Key 5 | Lockout |
| 38 | Internal fault: Safety Key 6 | Lockout |
| 39 | Internal fault: Safety Key 7 | Lockout |
| 40 | Internal fault: Safety Key 8 | Lockout |
| 41 | Internal fault: Safety Key 9 | Lockout |
| 42 | Internal fault: Safety Key 10 | Lockout |
| 43 | Internal fault: Safety Key 11 | Lockout |
| 44 | Internal fault: Safety Key 12 | Lockout |
| 45 | Internal fault: Safety Key 13 | Lockout |
| 46 | Internal fault: Safety Key 14 | Lockout |
| 47 | Flame rod to ground leakage | Hold |
| 48 | Static flame (not flickering) | Hold |
| 49 | 24VAC voltage low/high | Hold |
| 50 | Modulation fault | Hold |
| 51 | Pump fault | Hold |
| 52 | Motor tachometer fault | Hold |
| 53 | AC inputs phase reversed | Lockout |
| 54 | Safety GVT model ID doesn’t match application’s model ID | Lockout |
| 55 | Application configuration data block CRC errors | Lockout |
| 56-57 | RESERVED | |
| 58 | Internal fault: HFS shorted to IAS | Lockout |
| 59 | Internal fault: Mux pin shorted | Lockout |
| 60 | Internal fault: HFS shorted to LFS | Lockout |
| 61 | Anti short cycle | Hold |
| 62 | Fan speed not proved | Hold |
| 63 | LCI OFF | Hold |
| 64 | PII OFF | N/A |

**Table 17-3 Hold and Lockout Codes**

| Code | Description | Note |
|---|---|---|
| 65 | Interrupted Airflow Switch OFF | Hold |
| 66 | Interrupted Airflow Switch ON | Hold |
| 67 | ILK OFF | Hold |
| 68 | ILK ON | N/A |
| 69 | Pilot test hold | Hold |
| 70 | Wait for leakage test completion | Hold |
| 71 | Input power frequency mismatch | Lockout |
| 72-77 | RESERVED | |
| 78 | Demand lost in run | Hold |
| 79 | Outlet high limit | Hold |
| 80 | DHW high limit | Disabled |
| 81 | Delta T limit | Hold / Lockout |
| 82 | Stack limit | Lockout |
| 83 | Delta T exchanger/outlet limit | Disabled |
| 84 | Delta T inlet/exchanger limit | Disabled |
| 85 | Inlet/Outlet inversion limit (See Table 17-1) | Hold |
| 86 | Exchanger/outlet inversion limit | Disabled |
| 87 | Inlet/exchanger inversion limit | Disabled |
| 88 | Outlet T-Rise limit (See Table 17-1) | Lockout |
| 89 | Exchanger T-rise limit | Disabled |
| 90 | Heat exchanger high limit | Disabled |
| 91 | Inlet sensor fault | Hold |
| 92 | Outlet sensor fault | Hold |
| 93 | DHW sensor fault | Hold |
| 94 | Header sensor fault | Hold |
| 95 | Stack sensor fault | Hold |
| 96 | Outdoor sensor fault | Hold |
| 97 | Internal fault: A2D mismatch | Lockout |
| 98 | Internal fault: Exceeded VSNSR voltage tolerance | Lockout |
| 99 | Internal fault: Exceeded 28V voltage tolerance | Lockout |
| 100 | Pressure sensor fault | Hold |
| 101 | Exchanger sensor fault | Disabled |
| 102-104 | RESERVED | |
| 105 | Flame detected out of sequence | Hold / Lockout |
| 106 | Flame lost in MFEP | Lockout |
| 107 | Flame lost early in run | Lockout |
| 108 | Flame lost in run | Lockout |
| 109 | Ignition failed | Lockout |
| 110 | Ignition failure occurred | Hold |
| 111 | Flame current lower than WEAK threshold | Hold |
| 112 | Pilot test flame timeout | Lockout |
| 113 | Flame circuit timeout | Lockout |
| 114-115 | RESERVED | |
| 116 | Wait for OK to Run | Disabled |
| 117 | Flap valve condensate fault | Disabled |
| 118 | Controller interaction system fault | Hold |
| 119 | Controller interaction communications fault | Hold |
| 120 | Flap valve backflow fault | Disabled |
| 121 | Flap valve fault | Disabled |

**Table 17-3 Hold and Lockout Codes**

| Code | Description | Note |
|---|---|---|
| 122 | Light off rate proving failed | Lockout |
| 123 | Purge rate proving failed | Lockout |
| 124 | High fire switch OFF | Hold |
| 125 | High fire switch stuck ON | Hold |
| 126 | Low fire switch OFF | Hold |
| 127 | Low fire switch stuck ON | Hold |
| 128 | Fan speed failed during pre-purge | Hold / Lockout |
| 129 | Fan speed failed during pre-ignition | Hold / Lockout |
| 130 | Fan speed failed during ignition | Hold / Lockout |
| 131 | Fan movement detected during standby | Hold |
| 132 | Fan speed failed during run | Hold |
| 133-135 | RESERVED | |
| 136 | Interrupted Airflow Switch failed to close | Hold |
| 137 | ILK failed to close | Hold |
| 138 | Flame too low | Lockout |
| 139-142 | RESERVED | |
| 143 | Internal fault: Flame bias out of range 1 | Lockout |
| 144 | Internal fault: Flame bias out of range 2 | Lockout |
| 145 | Internal fault: Flame bias out of range 3 | Lockout |
| 146 | Internal fault: Flame bias out of range 4 | Lockout |
| 147 | Internal fault: Flame bias out of range 5 | Lockout |
| 148 | Internal fault: Flame bias out of range 6 | Lockout |
| 149 | Flame detected | Hold / Lockout |
| 150 | Flame not detected | Hold |
| 151 | High fire switch ON | Hold / Lockout |
| 152 | Combustion pressure ON | Hold / Lockout |
| 153 | Combustion pressure OFF | Hold / Lockout |
| 154 | Purge fan switch ON | Hold / Lockout |
| 155 | Purge fan switch OFF | Hold / Lockout |
| 156 | Combustion pressure and Flame ON | Hold / Lockout |
| 157 | Combustion pressure and Flame OFF | Lockout |
| 158 | Main valve ON | Lockout |
| 159 | Main valve OFF | Lockout |
| 160 | Ignition ON | Lockout |
| 161 | Ignition OFF | Lockout |
| 162 | Pilot valve ON | Lockout |
| 163 | Pilot valve OFF | Lockout |
| 164 | Block intake ON | Lockout |
| 165 | Block intake OFF | Lockout |
| 166-168 | RESERVED | |
| 169 | Safety opto bad in test state | Lockout |
| 170 | Safety relay opto feedback incorrect | Lockout |
| 171 | Safety relay feedback incorrect in run | Lockout |
| 172 | Main relay feedback incorrect | Lockout |
| 173 | Pilot relay feedback incorrect | Lockout |
| 174 | Safety relay feedback incorrect | Lockout |
| 175 | Safety relay open | Lockout |
| 176 | Main relay ON at safe start check | Lockout |
| 177 | Pilot relay ON at safe start check | Lockout |

**Table 17-3 Hold and Lockout Codes**

| Code | Description | Note |
|---|---|---|
| 178 | Safety relay ON at safe start check | Lockout |
| 179-180 | RESERVED | |
| 181 | Invalid Blocked condensate enable setting | Disabled |
| 182 | Invalid J7-1 configuration, both LFS and Blocked condensate | Disabled |
| 183 | Invalid J7-2 configuration, both HFS and Flap valve | Disabled |
| 184 | Invalid BLOWER/HSI output setting | Lockout |
| 185 | Invalid Delta T limit enable setting | Lockout |
| 186 | Invalid Delta T limit response setting | Lockout |
| 187 | Invalid DHW high limit enable setting | Lockout |
| 188 | Invalid DHW high limit response setting | Lockout |
| 189 | Invalid Flame sensor type setting | Lockout |
| 190 | Invalid interrupted air switch enable setting | Lockout |
| 191 | Invalid interrupted air switch start check enable setting | Lockout |
| 192 | Invalid Igniter on during setting | Lockout |
| 193 | Invalid Ignite failure delay setting | Lockout |
| 194 | Invalid Ignite failure response setting | Lockout |
| 195 | Invalid Ignite failure retries setting | Lockout |
| 196 | Invalid Ignition source setting | Lockout |
| 197 | Invalid Interlock open response setting | Lockout |
| 198 | Invalid Interlock start check setting | Lockout |
| 199 | Invalid LCI enable setting | Lockout |
| 200 | Invalid light off rate setting | Lockout |
| 201 | Invalid Light off rate proving setting | Lockout |
| 202 | Invalid Main Flame Establishing Period time setting | Lockout |
| 203 | Invalid MFEP flame failure response setting | Lockout |
| 204 | Invalid NTC sensor type setting | Lockout |
| 205 | Invalid Outlet high limit response setting | Lockout |
| 206 | Invalid Pilot Flame Establishing Period setting | Lockout |
| 207 | Invalid PII enable setting | Lockout |
| 208 | Invalid pilot test hold setting | Lockout |
| 209 | Invalid Pilot type setting | Lockout |
| 210 | Invalid Post-purge time setting | Lockout |
| 211 | Invalid Power up with lockout setting | Lockout |
| 212 | Invalid Pre-ignition time setting | Lockout |
| 213 | Invalid Pre-purge rate setting | Lockout |
| 214 | Invalid Pre-purge time setting | Lockout |
| 215 | Invalid Purge rate proving setting | Lockout |
| 216 | Invalid Run flame failure response setting | Lockout |
| 217 | Invalid Run stabilization time setting | Lockout |
| 218 | Invalid Stack limit enable setting | Lockout |
| 219 | Invalid Stack limit response setting | Lockout |
| 220 | Unconfigured Delta T limit set point setting | Lockout |
| 221 | Unconfigured DHW high limit set point setting | Lockout |
| 222 | Unconfigured Outlet high limit set point setting | Lockout |
| 223 | Unconfigured Stack limit set point setting | Lockout |
| 224 | Invalid DHW demand source setting | Lockout |
| 225 | Invalid Flame threshold setting | Lockout |
| 226 | Invalid Outlet high limit set point setting | Lockout |
| 227 | Invalid DHW high limit set point setting | Lockout |

**Table 17-3 Hold and Lockout Codes**

| Code | Description | Note |
|---|---|---|
| 228 | Invalid Stack limit set point setting | Lockout |
| 229 | Invalid Modulation output setting | Lockout |
| 230 | Invalid CH demand source setting | Lockout |
| 231 | Invalid Delta T limit delay setting | Lockout |
| 232 | Invalid Pressure sensor type setting | Lockout |
| 233 | Invalid IAS closed response setting | Lockout |
| 234 | Invalid Outlet high limit enable setting | Lockout |
| 235 | Invalid Outlet connector type setting | Lockout |
| 236 | Invalid Inlet connector type setting | Lockout |
| 237 | Invalid DHW connector type setting | Lockout |
| 238 | Invalid Stack connector type setting | Lockout |
| 239 | Invalid Header connector type setting | Lockout |
| 240 | Invalid Outdoor connector type setting | Lockout |
| 241 | Exchanger sensor not allowed with stack connector setting | Lockout |
| 242 | Invalid DHW auto detect configuration | Lockout |
| 243 | Invalid UV with spark interference not compatible with Igniter on throughout | Lockout |
| 244 | Internal fault: Safety relay test invalid state | Lockout |
| 245 | Invalid Outlet connector type setting for T-rise | Lockout |
| 246 | 4-20mA cannot be used for both modulation and setpoint control | Lockout |
| 247 | Invalid ILK bounce detection enable | Lockout |
| 248 | Invalid forced recycle interval | Lockout |
| 249 | STAT cannot be demand source when Remote Stat is enabled | Lockout |
| 250 | Invalid Fan speed error response | Lockout |
| 251 | Lead drop-stage on error setting does not match drop method configuration | Lockout |
| 252 | Invalid Line frequency setting | Lockout |
| 253 | Lead Lag modulation sensor not valid with setpoint source | Lockout |
| 254 | Lead Lag modulation sensor not valid with local setpoint source | Lockout |
| 255 | Lead Lag modulation sensor not valid with local modulation source | Lockout |
| 256 | Selected Controller interaction enable setting is not allowed | Lockout |
| 257 | Controller interaction enable does not match neighbor stack fault setting | Lockout |
| 258 | Controller ID must be non-zero if controller interaction is enabled | Lockout |
| 259 | Modulation output must be fan if controller interaction is enabled | Lockout |
| 260 | Asymmetrical paired (no flap) is set but flap switch input is energized | Lockout |
| 261 | Neighbor burner control blower fault detected | Lockout |
| 262 | Blower fault detected during flap test | Lockout |
| 263 | Invalid DHW demand temperature setting | Lockout |
| 264 | Invalid preferred outlet high limit setting | Lockout |
| 265 | Invalid preferred lightoff rate setting | Lockout |
| 266 | Invalid preferred stack limit rate setting | Lockout |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 0 | None (No alert) |
| 1 | Alert PCB was restored from factory defaults |
| 2 | Safety configuration parameters were restored from factory defaults |
| 3 | Configuration parameters were restored from factory defaults |
| 4 | Invalid Factory Invisibility PCB was detected |
| 5 | Invalid Factory Range PCB was detected |
| 6 | Invalid range PCB record has been dropped |
| 7 | EEPROM lockout history was initialized |
| 8 | Switched application annunciation data blocks |
| 9 | Switched application configuration data blocks |
| 10 | Configuration was restored from factory defaults |
| 11 | Backup configuration settings was restored from active configuration |
| 12 | Annunciation configuration was restored from factory defaults |
| 13 | Annunciation configuration was restored from backup |
| 14 | Safety group verification table was restored from factory defaults |
| 15 | Safety group verification table was updated |
| 16 | Invalid Parameter PCB was detected |
| 17 | Invalid Range PCB was detected |
| 18 | Alarm silence time exceeded maximum |
| 19 | Invalid safety group verification table was detected |
| 20 | Backdoor password could not be determined |
| 21 | Invalid safety group verification table was not accepted |
| 22 | CRC errors were found in application configuration data blocks |
| 23 | Backup Alert PCB was restored from active one |
| 24 | RESERVED |
| 25 | Lead Lag operation switch was turned OFF |
| 26 | Lead Lag operation switch was turned ON |
| 27 | Safety processor was reset |
| 28 | Application processor was reset |
| 29 | Burner switch was turned OFF |
| 30 | Burner switch was turned ON |
| 31 | Program Module (PM) was inserted into socket |
| 32 | Program Module (PM) was removed from socket |
| 33 | Alert PCB was configured |
| 34 | Parameter PCB was configured |
| 35 | Range PCB was configured |
| 36 | Program Module (PM) incompatible with product was inserted into socket |
| 37 | Program Module application parameter revision differs from application processor |
| 38 | Program Module safety parameter revision differs from safety processor |
| 39 | PCB incompatible with product contained in Program Module |
| 40 | Parameter PCB in Program Module is too large for product |
| 41 | Range PCB in Program Module was too large for product |
| 42 | Alert PCB in Program Module was too large for product |
| 43 | IAS start check was forced on due to IAS enabled |
| 44 | Low voltage was detected in safety processor |
| 45 | High line frequency occurred |
| 46 | Low line frequency occurred |
| 47 | Invalid subsystem reset request occurred |
| 48 | Write large enumerated Modbus register value was not allowed |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 49 | Maximum cycle count was reached |
| 50 | Maximum hours count was reached |
| 51 | Illegal Modbus write was attempted |
| 52 | Modbus write attempt was rejected (NOT ALLOWED) |
| 53 | Illegal Modbus read was attempted |
| 54 | Safety processor brown-out reset occurred |
| 55 | Application processor watchdog reset occurred |
| 56 | Application processor brown-out reset occurred |
| 57 | Safety processor watchdog reset occurred |
| 58 | Alarm was reset by the user at the control |
| 59 | Burner control firing rate was > absolute max rate |
| 60 | Burner control firing rate was < absolute min rate |
| 61 | Burner control firing rate was invalid, % vs. RPM |
| 62 | Burner control was firing with no fan request |
| 63 | Burner control rate (non-firing) was > absolute max rate |
| 64 | Burner control rate (non-firing) was < absolute min rate |
| 65 | Burner control rate (non-firing) was absent |
| 66 | Burner control rate (non-firing) was invalid, % vs. RPM |
| 67 | Fan off cycle rate was invalid, % vs. RPM |
| 68 | Set point was over ridden due to sensor fault |
| 69 | Modulation was over ridden due to sensor fault |
| 70 | No demand source was set due to demand priority conflicts |
| 71 | CH 4-20mA signal was invalid. |
| 72 | Flame strength rate differential was invalid |
| 73 | Flame strength step rate was invalid |
| 74 | Periodic forced recycle |
| 75 | Absolute max fan speed was out of range |
| 76 | Absolute min fan speed was out of range |
| 77 | Fan gain down was invalid |
| 78 | Fan gain up was invalid |
| 79 | Fan minimum duty cycle was invalid |
| 80 | Fan pulses per revolution was invalid |
| 81 | Fan PWM frequency was invalid |
| 82-83 | RESERVED |
| 84 | Lead Lag CH 4-20mA water temperature setting was invalid |
| 85 | No Lead Lag add stage error threshold was configured |
| 86 | No Lead Lag add stage detection time was configured |
| 87 | No Lead Lag drop stage error threshold was configured |
| 88 | No Lead Lag drop stage detection time was configured |
| 89 | Lead Lag all water heater off threshold was invalid |
| 90 | Modulation output type was invalid |
| 91 | Firing rate control parameter was invalid |
| 92 | Forced rate was out of range vs. min/max modulation |
| 93 | Forced rate was invalid, % vs. RPM |
| 94 | Slow start ramp value was invalid |
| 95 | Slow start degrees value was invalid |
| 96 | Slow start was ended due to outlet sensor fault |
| 97 | Slow start was end due to reference set point fault |
| 98 | CH max modulation rate was invalid, % vs. RPM |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 99 | CH max modulation rate was > absolute max rate |
| 100 | CH modulation range (max minus min) was too small (< 4% or 40 RPM) |
| 101 | DHW max modulation rate was invalid, % vs. RPM |
| 102 | DHW max modulation rate was > absolute max rate |
| 103 | DHW modulation range (max minus min) was too small (< 4% or 40 RPM) |
| 104 | Min modulation rate was < absolute min rate |
| 105 | Min modulation rate was invalid, % vs. RPM |
| 106 | Manual rate was invalid, % vs. RPM |
| 107 | Slow start enabled, but forced rate was invalid |
| 108 | Analog output hysteresis was invalid |
| 109 | Analog modulation output type was invalid |
| 110 | IAS open rate differential was invalid |
| 111 | IAS open step rate was invalid |
| 112 | Mix max modulation rate was invalid, % vs. RPM |
| 113 | Mix max modulation rate was > absolute max or < absolute min rates |
| 114 | Mix modulation range (max minus min) was too small (< 4% or 40 RPM) |
| 115 | Fan was limited to its minimum duty cycle |
| 116 | Manual rate was > CH max modulation rate |
| 117 | Manual rate was > DHW max modulation rate |
| 118 | Manual rate was < min modulation rate |
| 119 | Manual rate in Standby was > absolute max rate |
| 120 | Modulation commanded rate was > CH max modulation rate |
| 121 | Modulation commanded rate was > DHW max modulation rate |
| 122 | Modulation commanded rate was < min modulation rate |
| 123 | Modulation rate was limited due to outlet limit |
| 124 | Modulation rate was limited due to Delta-T limit |
| 125 | Modulation rate was limited due to stack limit |
| 126 | Modulation rate was limited due to anti-condensation |
| 127 | Fan Speed out of range in RUN |
| 128 | Modulation rate was limited due to IAS was open |
| 129 | Slow start ramp setting of zero will result in no modulation rate change |
| 130 | No forced rate was configured for slow start ramp |
| 131 | CH demand source was invalid |
| 132 | CH P-gain was invalid |
| 133 | CH I-gain was invalid |
| 134 | CH D-gain was invalid |
| 135 | CH OFF hysteresis was invalid |
| 136 | CH ON hysteresis was invalid |
| 137 | CH sensor type was invalid |
| 138 | CH hysteresis step time was invalid |
| 139 | CH remote control parameter was invalid |
| 140 | CH ODR not allowed with remote control |
| 146 | CH control was suspended due to fault |
| 147 | CH header temperature was invalid |
| 148 | CH outlet temperature was invalid |
| 149 | CH steam pressure was invalid |
| 151 | Minimum water temperature parameter was greater than setpoint |
| 152 | Minimum water temperature parameter was greater than time of day setpoint |
| 155 | CH modulation rate source parameter was invalid |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 157 | DHW demand source was invalid |
| 158 | DHW P-gain was invalid |
| 159 | DHW I-gain was invalid |
| 160 | DHW D-gain was invalid |
| 161 | DHW OFF hysteresis was invalid |
| 162 | DHW ON hysteresis was invalid |
| 163 | DHW hysteresis step time was invalid |
| 164 | DHW sensor type was invalid |
| 165 | Inlet sensor type was invalid for DHW |
| 166 | Outlet sensor type was invalid for DHW |
| 167 | DHW storage OFF hysteresis was invalid |
| 168 | DHW storage ON hysteresis was invalid |
| 169 | DHW modulation sensor type was invalid |
| 170 | DHW modulation sensor was not compatible for Auto mode |
| 171 | DHW control was suspended due to fault |
| 172 | DHW temperature was invalid |
| 173 | DHW inlet temperature was invalid |
| 174 | DHW outlet temperature was invalid |
| 175 | DHW high limit must be disabled for Auto mode |
| 176 | DHW sensor type was not compatible for Auto mode |
| 177 | DHW priority source setting was invalid |
| 178 | DHW priority method setting was invalid |
| 179 | CH S5 (J8-11) sensor was invalid |
| 180 | CH Inlet temperature was invalid |
| 181 | CH S10 (J10-7) sensor was invalid |
| 182 | Lead Lag CH setpoint source was invalid |
| 183 | Lead Lag P-gain was invalid |
| 184 | Lead Lag I-gain was invalid |
| 185 | Lead Lag D-gain was invalid |
| 186 | Lead Lag OFF hysteresis was invalid |
| 187 | Lead Lag ON hysteresis was invalid |
| 188 | Lead Lag slave enable was invalid |
| 189 | Lead Lag hysteresis step time was invalid |
| 190 | No Lead Lag Modbus port was assigned |
| 191 | Lead Lag base load common setting was invalid |
| 192 | Lead Lag DHW demand switch setting was invalid |
| 193 | Lead Lag Mix demand switch setting was invalid |
| 194 | Lead Lag modulation sensor setting was invalid |
| 195 | Lead Lag backup modulation sensor setting was invalid |
| 196 | Lead Lag slave mode setting was invalid |
| 197 | Lead Lag rate allocation setting was invalid |
| 198 | Lead selection setting was invalid |
| 199 | Lag selection setting was invalid |
| 200 | Lead Lag slave return setting was invalid |
| 201 | Lead Lag add stage method setting was invalid |
| 202 | STAT may not be a Lead Lag CH demand source when Remote Stat is enabled |
| 203 | Lead Lag base load rate setting was invalid |
| 204 | Lead Lag master was suspended due to fault |
| 205 | Lead Lag slave was suspended due to fault |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 206 | Lead Lag header temperature was invalid |
| 207 | Lead Lag was suspended due to no enabled Program Module installed |
| 208 | Lead Lag slave session has timed out |
| 209 | Too many Lead Lag slaves were detected |
| 210 | Lead Lag slave was discovered |
| 211 | Incompatible Lead Lag slave was discovered |
| 212 | No base load rate was set for Lead Lag slave |
| 213 | Lead Lag slave unable to fire before demand to fire delay expired |
| 214 | Adding Lead Lag slave aborted due to add requirement change |
| 215 | No Lead Lag slaves available to service demand |
| 216 | No Lead Lag active service was set due to demand priority conflicts |
| 217 | No Lead Lag add stage method was specified |
| 218 | No Lead Lag drop stage method was specified |
| 219 | Using backup Lead Lag header sensor due to sensor failure |
| 220 | Lead Lag frost protection rate was invalid |
| 221 | Lead Lag drop stage method setting was invalid |
| 222 | CH frost protection temperature was invalid |
| 223 | CH frost protection inlet temperature was invalid |
| 224 | DHW frost protection temperature was invalid |
| 225 | No anticondensation setpoint was configured for frost protection |
| 226 | RESERVED |
| 227 | DHW priority override time was not derated due to invalid outdoor temperature |
| 228 | Warm weather shutdown was not checked due to invalid outdoor temperature |
| 229 | Lead Lag slave communication timeout |
| 230 | RESERVED |
| 231 | LL set point was invalid |
| 232 | LL time of day set point was invalid |
| 233 | LL outdoor temperature was invalid |
| 234 | LL ODR time of day set point was invalid |
| 235 | LL ODR time of day set point exceeded normal set point |
| 236 | LL max outdoor set point was invalid |
| 237 | LL min outdoor set point was invalid |
| 238 | LL min water set point was invalid |
| 239 | LL outdoor temperature range was too small (minimum 12 C / 22 F) |
| 240 | LL water temperature range was too small (minimum 12 C / 22 F) |
| 241 | Lead Lag DHW setpoint was invalid |
| 243 | Lead Lag CH demand switch was invalid |
| 244 | Lead Lag ODR min water temperature was invalid |
| 245 | RESERVED |
| 246 | CH set point was invalid |
| 247 | CH time of day set point was invalid |
| 248 | CH outdoor temperature was invalid |
| 249 | CH ODR time of day setpoint was invalid |
| 250 | CH ODR time of day set point exceeds normal set point |
| 251 | CH max outdoor set point was invalid |
| 252 | CH min outdoor setp oint was invalid |
| 253 | CH min water set point was invalid |
| 254 | CH outdoor temperature range was too small (minimum 12 C / 22 F) |
| 255 | CH water temperature range was too small (minimum 12 C / 22 F) |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 259 | CH ODR min water temperature was invalid |
| 260 | RESERVED |
| 261 | DHW set point was invalid |
| 262 | DHW time of day set point was invalid |
| 263 | DHW storage setpoint was invalid |
| 264 | STAT may not be a DHW demand source when Remote Stat is enabled |
| 265 | No DHW anticondensation setpoint was configured |
| 266 | No CH anticondensation setpoint was configured |
| 267 | STAT may not be a CH demand source when Remote Stat is enabled |
| 268 | CH 4mA water temperature setting was invalid |
| 269 | CH 20mA water temperature setting was invalid |
| 270 | Steam 4mA water temperature setting was invalid |
| 271 | Steam 20mA water temperature setting was invalid |
| 272 | Abnormal Recycle: Pressure sensor fault |
| 273 | Abnormal Recycle: Safety relay drive test failed |
| 274 | Abnormal Recycle: Demand off during Pilot Flame Establishing Period |
| 275 | Abnormal Recycle: LCI off during Drive to Purge Rate |
| 276 | Abnormal Recycle: LCI off during Measured Purge Time |
| 277 | Abnormal Recycle: LCI off during Drive to Light off Rate |
| 278 | Abnormal Recycle: LCI off during Pre-Ignition test |
| 279 | Abnormal Recycle: LCI off during Pre-Ignition time |
| 280 | Abnormal Recycle: LCI off during Main Flame Establishing Period |
| 281 | Abnormal Recycle: LCI off during Ignition period |
| 282 | Abnormal Recycle: Demand off during Drive to Purge Rate |
| 283 | Abnormal Recycle: Demand off during Measured Purge Time |
| 284 | Abnormal Recycle: Demand off during Drive to Light off Rate |
| 285 | Abnormal Recycle: Demand off during Pre-Ignition test |
| 286 | Abnormal Recycle: Demand off during Pre-Ignition time |
| 287 | Abnormal Recycle: Flame was on during Safe Start check |
| 288 | Abnormal Recycle: Flame was on during Drive to Purge Rate |
| 289 | Abnormal Recycle: Flame was on during Measured Purge Time |
| 290 | Abnormal Recycle: Flame was on during Drive to Light off Rate |
| 291 | Abnormal Recycle: Flame was not on at end of Ignition period |
| 292 | Abnormal Recycle: Flame was lost during Main Flame Establishing Period |
| 293 | Abnormal Recycle: Flame was lost early in Run |
| 294 | Abnormal Recycle: Flame was lost during Run |
| 295 | Abnormal Recycle: Leakage test failed |
| 296 | Abnormal Recycle: Interrupted air flow switch was off during Drive to Purge Rate |
| 297 | Abnormal Recycle: Interrupted air flow switch was off during Measured Purge Time |
| 298 | Abnormal Recycle: Interrupted air flow switch was off during Drive to Light off Rate |
| 299 | Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition test |
| 300 | Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition time |
| 301 | Abnormal Recycle: Interrupted air flow switch was off during Main Flame Establishing Period |
| 302 | Abnormal Recycle: Ignition failed due to interrupted air flow switch was off |
| 303 | Abnormal Recycle: ILK off during Drive to Purge Rate |
| 304 | Abnormal Recycle: ILK off during Measured Purge Time |
| 305 | Abnormal Recycle: ILK off during Drive to Light off Rate |
| 306 | Abnormal Recycle: ILK off during Pre-Ignition test |
| 307 | Abnormal Recycle: ILK off during Pre-Ignition time |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 308 | Abnormal Recycle: ILK off during Main Flame Establishing Period |
| 309 | Abnormal Recycle: ILK off during Ignition period |
| 310 | Run was terminated due to ILK was off |
| 311 | Run was terminated due to interrupted air flow switch was off |
| 312 | Stuck reset switch |
| 313 | Run was terminated due to fan failure |
| 314 | Abnormal Recycle: Fan failed during Drive to Purge Rate |
| 315 | Abnormal Recycle: Fan failed during Measured Purge Time |
| 316 | Abnormal Recycle: Fan failed during Drive to Light off Rate |
| 317 | Abnormal Recycle: Fan failed during Pre-Ignition test |
| 318 | Abnormal Recycle: Fan failed during Pre-Ignition time |
| 319 | Abnormal Recycle: Fan failed during Ignition period |
| 320 | Abnormal Recycle: Fan failed during Main Flame Establishing Period |
| 321 | Abnormal Recycle: Main Valve off after 10 seconds of RUN |
| 322 | Abnormal Recycle: Pilot Valve off after 10 seconds of RUN |
| 323 | Abnormal Recycle: Safety Relay off after 10 seconds of RUN |
| 324 | Abnormal Recycle: Hardware flame bias |
| 325 | Abnormal Recycle: Hardware static flame |
| 326 | Abnormal Recycle: Hardware flame current invalid |
| 327 | Abnormal Recycle: Hardware flame rod short |
| 328 | Abnormal Recycle: Hardware invalid power |
| 329 | Abnormal Recycle: Hardware invalid AC line |
| 330 | Abnormal Recycle: Hardware SLO flame ripple |
| 331 | Abnormal Recycle: Hardware SLO flame sample |
| 332 | Abnormal Recycle: Hardware SLO flame bias range |
| 333 | Abnormal Recycle: Hardware SLO flame bias heat |
| 334 | Abnormal Recycle: Hardware SLO spark stuck |
| 335 | Abnormal Recycle: Hardware SLO spark changed |
| 336 | Abnormal Recycle: Hardware SLO static flame |
| 337 | Abnormal Recycle: Hardware SLO rod shorted |
| 338 | Abnormal Recycle: Hardware SLO AD linearity |
| 339 | Abnormal Recycle: Hardware SLO bias not set |
| 340 | Abnormal Recycle: Hardware SLO bias shorted |
| 341 | Abnormal Recycle: Hardware SLO electronics |
| 342 | Abnormal Recycle: Hardware processor clock |
| 343 | Abnormal Recycle: Hardware AC phase |
| 344 | Abnormal Recycle: Hardware A2D mismatch |
| 345 | Abnormal Recycle: Hardware VSNSR A2D |
| 346 | Abnormal Recycle: Hardware 28V A2D |
| 347 | Abnormal Recycle: Hardware HFS IAS shorted |
| 348 | Abnormal Recycle: Hardware PII INTLK shorted |
| 349 | Abnormal Recycle: Hardware HFS LCI shorted |
| 350 | Abnormal Recycle: Hardware HFS LFS shorted |
| 351 | Abnormal Recycle: Invalid zero crossing |
| 352 | Abnormal Recycle: fault stack sensor |
| 353 | Abnormal Recycle: stack limit |
| 354 | Abnormal Recycle: delta T limit |
| 355 | Abnormal Recycle: fault outlet sensor |
| 356 | Abnormal Recycle: outlet high limit |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 357 | Abnormal Recycle: fault DHW sensor |
| 358 | Abnormal Recycle: DHW high limit |
| 359 | Abnormal Recycle: fault inlet sensor |
| 360 | Abnormal Recycle: Check Parameters Failed |
| 361 | Internal error: No factory parameters were detected in control |
| 362 | Internal error: PID iteration frequency was invalid |
| 363 | Internal error: Demand-Rate interval time was invalid |
| 364 | Internal error: Factory calibration parameter for modulation was invalid |
| 365 | Internal error: CH PID P-scaler was invalid |
| 366 | Internal error: CH PID I-scaler was invalid |
| 367 | Internal error: CH PID D-scaler was invalid |
| 368 | Internal error: DHW PID P-scaler was invalid |
| 369 | Internal error: DHW PID I-scaler was invalid |
| 370 | Internal error: DHW PID D-scaler was invalid |
| 371 | Internal error: Lead Lag master PID P-scaler was invalid |
| 372 | Internal error: Lead Lag master PID I-scaler was invalid |
| 373 | Internal error: Lead Lag master PID D-scaler was invalid |
| 374 | Abnormal Recycle: Hardware flame bias high |
| 375 | Abnormal Recycle: Hardware flame bias low |
| 376 | Abnormal Recycle: Hardware flame bias delta high |
| 377 | Abnormal Recycle: Hardware flame bias delta low |
| 378 | Abnormal Recycle: Hardware flame bias dynamic high |
| 379 | Abnormal Recycle: Hardware flame bias dynamic low |
| 380 | Abnormal Recycle: Fan Speed Not Proven |
| 381 | Abnormal Recycle: Fan Speed Range Low |
| 382 | Abnormal Recycle: Fan Speed Range High |
| 383 | Abnormal Recycle: Pre-Ignition test failed, recycle |
| 384-388 | RESERVED |
| 389 | Abnormal Recycle: AC power frequency Mismatch |
| 390-447 | RESERVED |
| 448 | Flame too low |
| 449 | Modulation rate was limited due to flame strength |
| 450 | RESERVED |
| 451 | Circulator control was invalid |
| 452 | Circulator P-gain was invalid |
| 453 | Circulator I-gain was invalid |
| 454 | Circulator temperature was invalid |
| 455 | Circulator outlet temperature was invalid |
| 456 | Circulator inlet temperature was invalid |
| 457 | Circulator outlet temperature was invalid |
| 458 | Circulator sensor choice was invalid |
| 459 | Circulator PID setpoint was invalid |
| 460 | LCI demand lost in run |
| 461 | Demand lost in run |
| 462 | STAT demand lost in run |
| 463 | Demand lost in run due to no flame |
| 464 | LCI lost in Combustion Pressure Establishing Period |
| 465 | LCI lost in Combustion Pressure Stabilizing Period |
| 466 | RESERVED |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 467 | Internal error: EEPROM write was attempted before EEPROM was initialized |
| 468 | Internal error: EEPROM cycle count address was invalid |
| 469 | Internal error: EEPROM days count address was invalid |
| 470 | Internal error: EEPROM hours count address was invalid |
| 471 | Internal error: Lockout record EEPROM index was invalid |
| 472 | Internal error: Request to write PM status was invalid |
| 473 | Internal error: PM parameter address was invalid |
| 474 | Internal error: PM safety parameter address was invalid |
| 475 | Internal error: Invalid record in lockout history was removed |
| 476 | Internal error: EEPROM write buffer was full |
| 477 | Internal error: Data too large was not written to EEPROM |
| 478 | Internal error: Safety key bit 0 was incorrect |
| 479 | Internal error: Safety key bit 1 was incorrect |
| 480 | Internal error: Safety key bit 2 was incorrect |
| 481 | Internal error: Safety key bit 3 was incorrect |
| 482 | Internal error: Safety key bit 4 was incorrect |
| 483 | Internal error: Safety key bit 5 was incorrect |
| 484 | Internal error: Safety key bit 6 was incorrect |
| 485 | Internal error: Safety key bit 7 was incorrect |
| 486 | Internal error: Safety key bit 8 was incorrect |
| 487 | Internal error: Safety key bit 9 was incorrect |
| 488 | Internal error: Safety key bit 10 was incorrect |
| 489 | Internal error: Safety key bit 11 was incorrect |
| 490 | Internal error: Safety key bit 12 was incorrect |
| 491 | Internal error: Safety key bit 13 was incorrect |
| 492 | Internal error: Safety key bit 14 was incorrect |
| 493 | Internal error: Safety key bit 15 was incorrect |
| 494 | Internal error: Safety relay timeout |
| 495 | Internal error: Safety relay commanded off |
| 496 | Internal error: Unknown safety error occurred |
| 497 | Internal error: Safety timer was corrupt |
| 498 | Internal error: Safety timer was expired |
| 499 | Internal error: Safety timings |
| 500 | Internal error: Safety shutdown |
| 550 | Delta T inlet/outlet limit was exceeded |
| 553 | Inlet/outlet inversion occurred |
| 564 | Outlet T-rise limit was exceeded |
| 600 | Delta T inlet temperature was invalid |
| 601 | Delta T outlet temperature was invalid |
| 603 | CH ODR boost max offpoint temperature was invalid |
| 604 | CH ODR boost max offpoint temperature was too low |
| 605 | Lead Lag ODR boost max offpoint temperature was invalid |
| 606 | Lead Lag ODR boost max offpoint temperature was too low |
| 609 | Time to rotate lead water heater to next firing slave |
| 610 | Time to rotate lead water heater to next available slave |
| 611 | Time to rotate lead water heater to first firing slave in order |
| 612 | Time to rotate lead water heater to lowest running slave |
| 613 | Lead water heater was rotated based on new firing sequence order |
| 614 | Lead water heater was rotated based on measured run time |

**Table 17-4 Alert Codes**

| Code | Description |
|---|---|
| 615 | Parameter PCB was switched to backup |
| 616 | Range PCB was switched to backup |
| 622 | Lead Lag modulation sensor was not valid with setpoint source |
| 623 | Lead Lag modulation sensor was not valid with local setpoint source |
| 624 | Lead Lag modulation sensor was not valid with local modulation rate source |
| 629 | Disagreement on number of interacting controls |

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