Installation Instructions and Use & Care Guide

Non-Condensing Residential Gas Tankless Water Heater

Residential On-Demand Gas Tankless Water Heater
(X3® TECHNOLOGY available on some models)

Read this manual and the labels on the water heater before you install, operate, or service it. This water heater is designed for Natural Gas operation only. If you have difficulty following the directions, or aren't sure you can safely and properly do any of this work yourself:

- Call our Technical Assistance Hotline which is listed on your warranty. We can help you with installation, operations, troubleshooting, or maintenance. Before you call, write down the model and serial number from the water heater's data plate.
- Incorrect installation, operation, or service can damage the water heater, your house and other property, and present risks including fire, scalding, electric shock, and explosion, causing serious injury or death.

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- **Do not try to light any appliance.**
- **Do not touch any electrical 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.**

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

TI INDOOR MODEL
(X3® CONFIGURATION)



TO OUTDOOR MODEL
(X3® CONFIGURATION)



MODELS:

TI-180X3-N	TO-180X3-N
TI-180B-N	TO-180B-N
TI-199X3-N	TO-199X3-N
TI-199B-N	TO-199B-N

NATURAL GAS ONLY

LOW LEAD CONTENT

DESIGN CERTIFIED®

Keep this manual in the pocket on heater for future reference whenever maintenance, adjustment or service is required.
Retain your original receipt as proof of purchase.

November 2025

100385425_2000839619

TABLE OF CONTENTS

WATER HEATER BASICS 4

Component Overview (Indoor Model) 4

Component Overview (Outdoor Model) 5

Typical Installation (Indoor Model) 6

Typical Installation (Outdoor Model) 7

Dimensions (Indoor Model) 8

Dimensions (Outdoor Model) 9

Supply Connections 10

Product Specification and Technical Data (Indoor Model) 11

Product Specification and Technical Data (Outdoor Model) 12

IMPORTANT SAFETY INFORMATION 13

RISKS DURING INSTALLATION AND MAINTENANCE 14

RISKS DURING OPERATION 14

GETTING STARTED 16

Read Before Installation 16

Recommended Tools and Materials 19

Recommended Accessories 19

Included Items 20

Available Accessories 21

INSTALLATION 22

Installation Environment 22

Unit Clearances 22

Mounting the Water Heater (Indoor Model) 23

Mounting the Water Heater (Outdoor Model) 23

Venting (Indoor Model) 24

Replacing a Water Heater Using the Existing Vent System 25

Vent Length and Number of Elbows Allowed 25

Venting Illustrations 27

Clearances for Sidewall Terminations (Indoor Model) 30

Clearances for Multi-Unit Water Heaters (Outdoor Model) 31

Clearances for Rooftop Terminations 32

Gas Supply and Gas Pipe Sizing 33

Water Connections 35

TABLE OF CONTENTS

X3® Technology 36

Pressure Relief Valve 37

Recirculation 38

Electrical Connections 40

Accessory Connections 41

Cascade System 44

OPERATION **46**

FOR YOUR SAFETY, READ BEFORE OPERATING 46

Start-Up Instructions 46

Shut-Down Instructions 46

Emergency Shut-Down 46

User Interface Module (UIM) & Remote Controller Display Overview 48

Temperature Settings 49

Configuration Mode (C Mode) 50

Cascade Configuration 51

Unit Conversion Mode 51

MAINTENANCE **52**

Regular Maintenance 52

Freeze Protection System 52

Unit Draining & Power Outage (Freeze Protection) 53

Inlet Water Filter 53

TROUBLESHOOTING **54**

General Troubleshooting 54

Error Codes 56

Fault Analysis of Error Codes 57

COMPONENTS **62**

Component View (Indoor Model) 62

Component View (Outdoor Model) 64

Components List 66

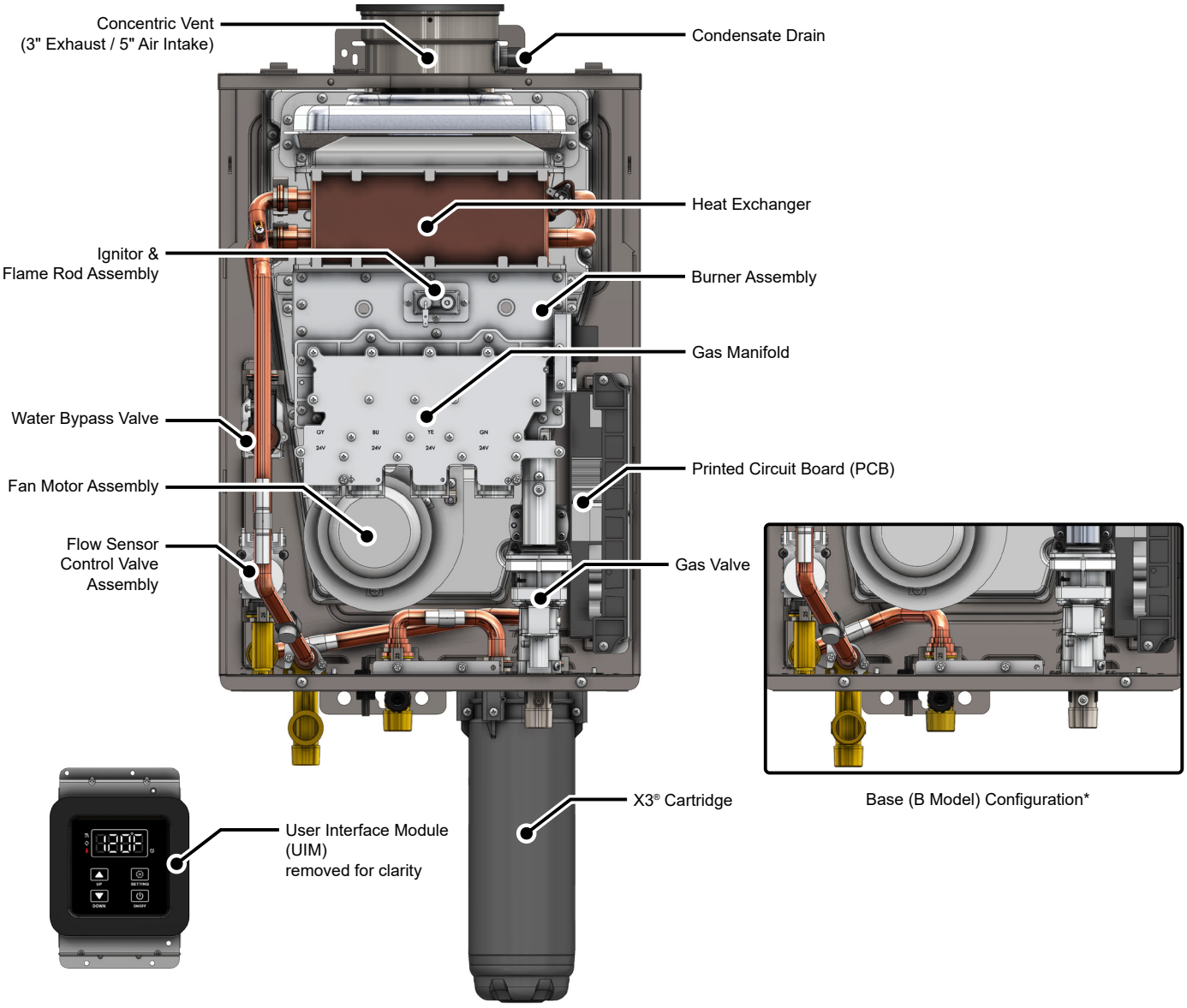
APPENDIX **67**

Electrical Wiring Diagram 67

Flow Rate Capacity Chart 68

NOTES **69**

Component Overview (Indoor Model)



X3® Technology (X3® Model):

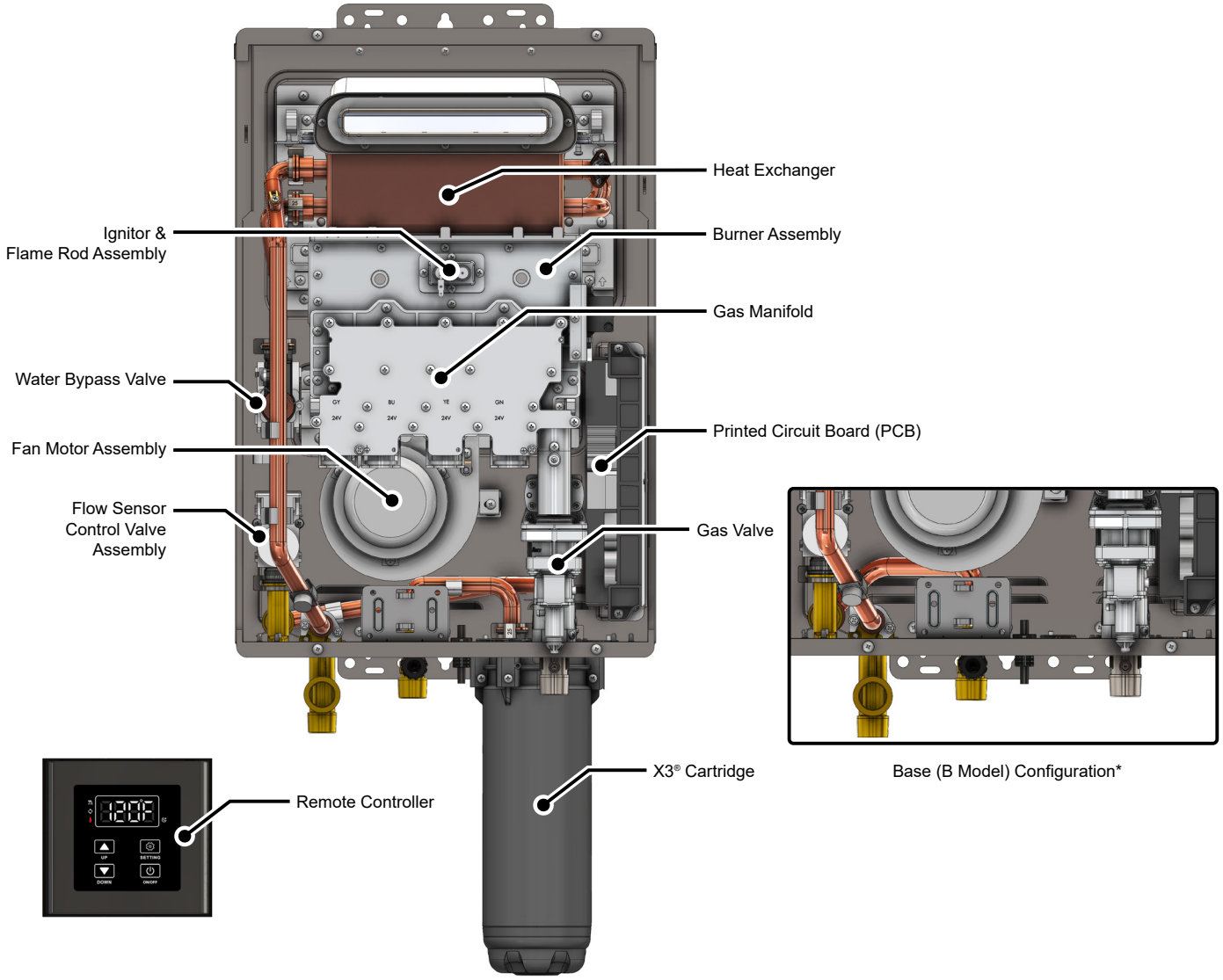
This water heater is equipped with X3® Scale Prevention Technology to inhibit scale formation within the heat exchanger tubing of this unit. Part of the X3® Technology's anti-scale protection comes from the special X3® Cartridge media. The X3® Cartridge must be installed into the manifold located on the underside of the heater cabinet prior to operation of the unit. X3® Scale Prevention Technology reduces the formation of scale in the heat exchanger, extending the operating life of the unit in typical potable water installations. Specific water conditions may impact the efficiency of X3®, such as excessive iron or manganese levels. The maximum allowable limit of iron is 0.3 mg/l or 0.3 ppm and manganese is 0.05 mg/l or 0.05 ppm. Levels greater than these will reduce the effectiveness of the X3®. Refer to the guidelines below and consult a water quality expert to determine if your water is within acceptable X3® and EPA guidelines.

NOTICE: Pressure Relief Valve supplied in the box with this model.

***B Model:** The base non-condensing model with no integrated X3® cartridge.

NOTICE: Pressure Relief Valve will need to be field supplied with this model.

Component Overview (Outdoor Model)



Base (B Model) Configuration*

X3® Technology (X3® Model):

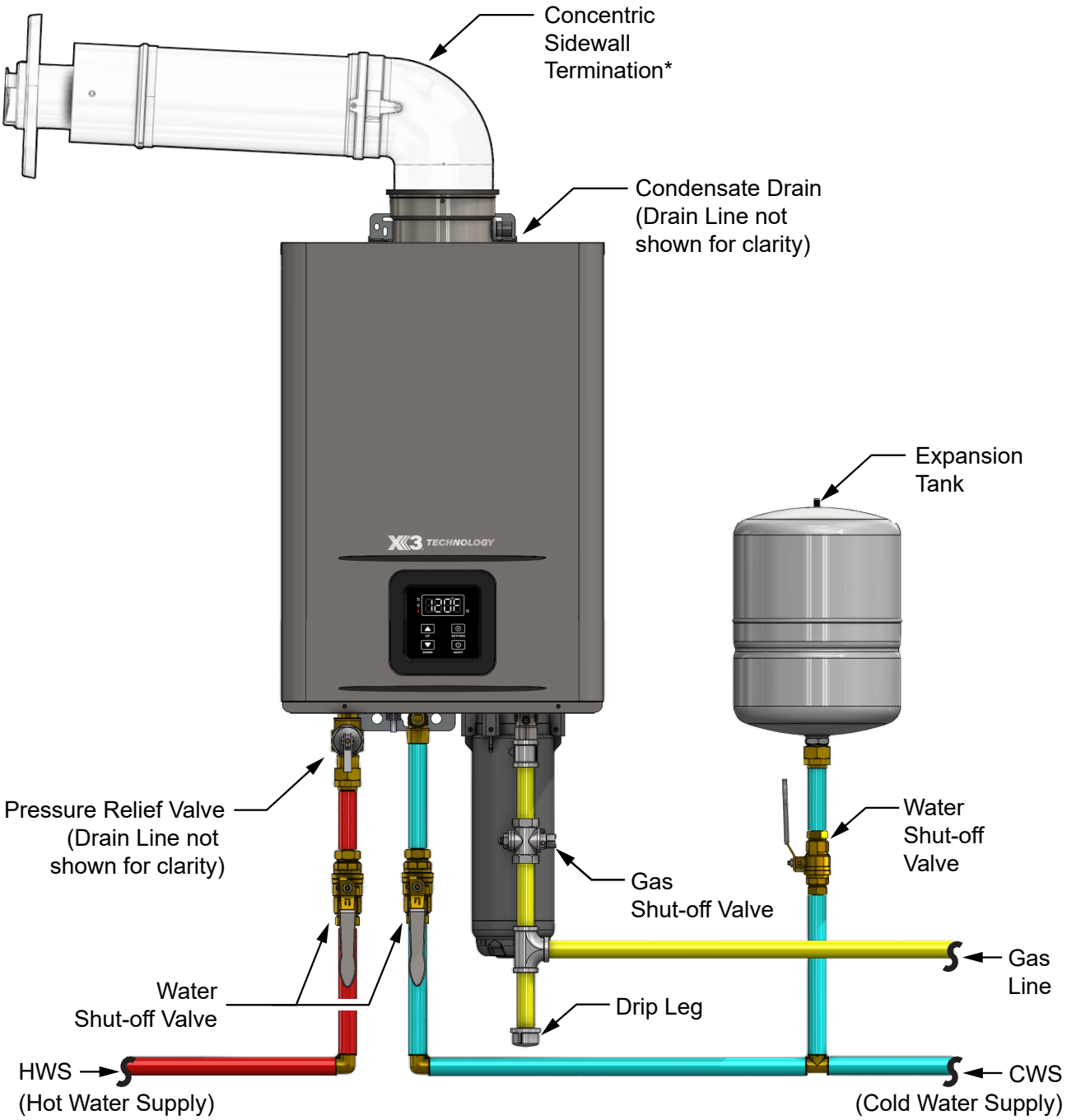
This water heater is equipped with X3® Scale Prevention Technology to inhibit scale formation within the heat exchanger tubing of this unit. Part of the X3® Technology's anti-scale protection comes from the special X3® Cartridge media. The X3® Cartridge must be installed into the manifold located on the underside of the heater cabinet prior to operation of the unit. X3® Scale Prevention Technology reduces the formation of scale in the heat exchanger, extending the operating life of the unit in typical potable water installations. Specific water conditions may impact the efficiency of X3®, such as excessive iron or manganese levels. The maximum allowable limit of iron is 0.3 mg/l or 0.3 ppm and manganese is 0.05 mg/l or 0.05 ppm. Levels greater than these will reduce the effectiveness of the X3®. Refer to the guidelines below and consult a water quality expert to determine if your water is within acceptable X3® and EPA guidelines.

NOTICE: Pressure Relief Valve supplied in the box with this model.

***B Model:** The base non-condensing model with no integrated X3® cartridge.

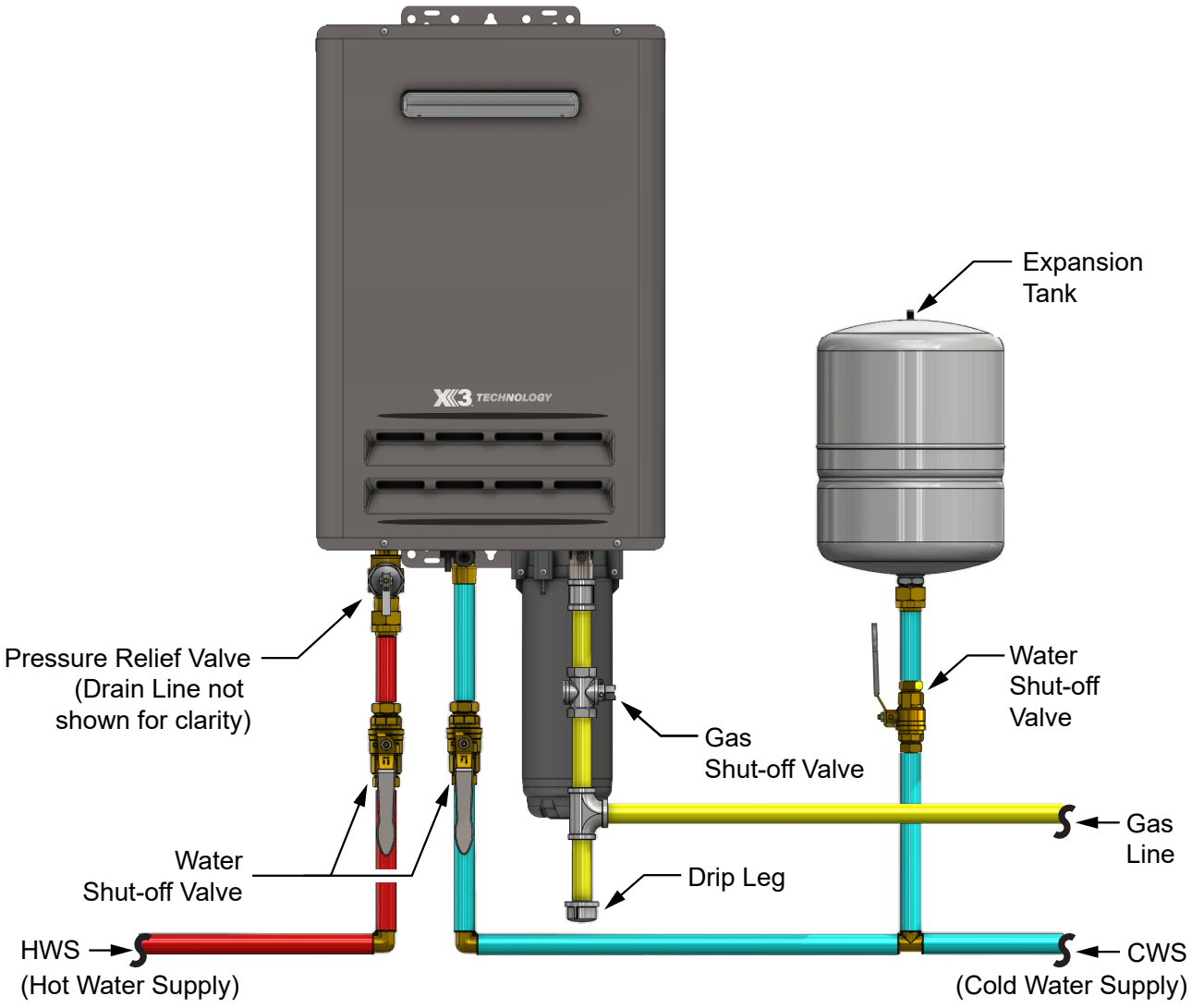
NOTICE: Pressure Relief Valve will need to be field supplied with this model.

Typical Installation (Indoor Model)

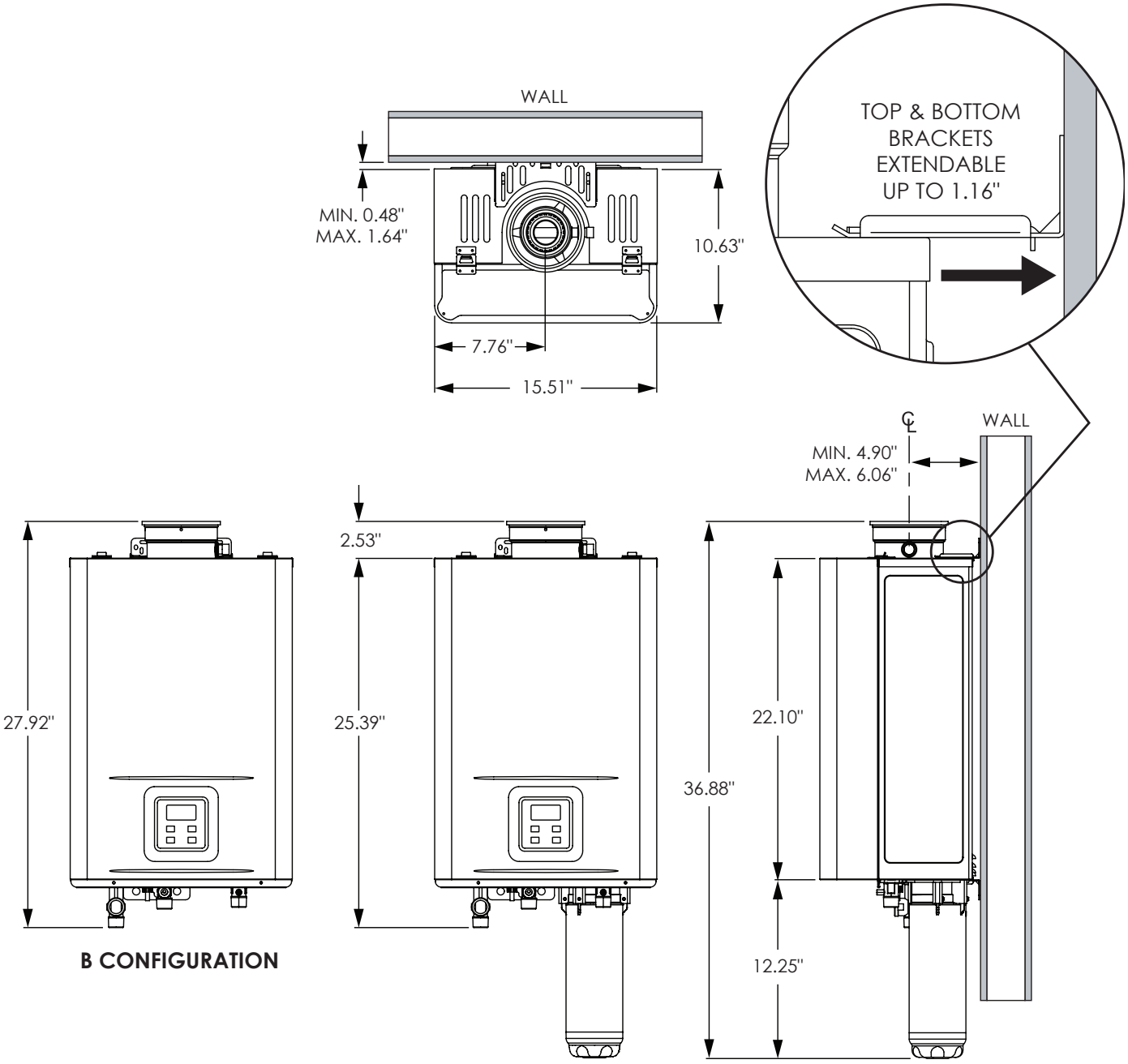


*Sidewall termination shown. Vertical concentric vent termination is also available (see page 28).

Typical Installation (Outdoor Model)



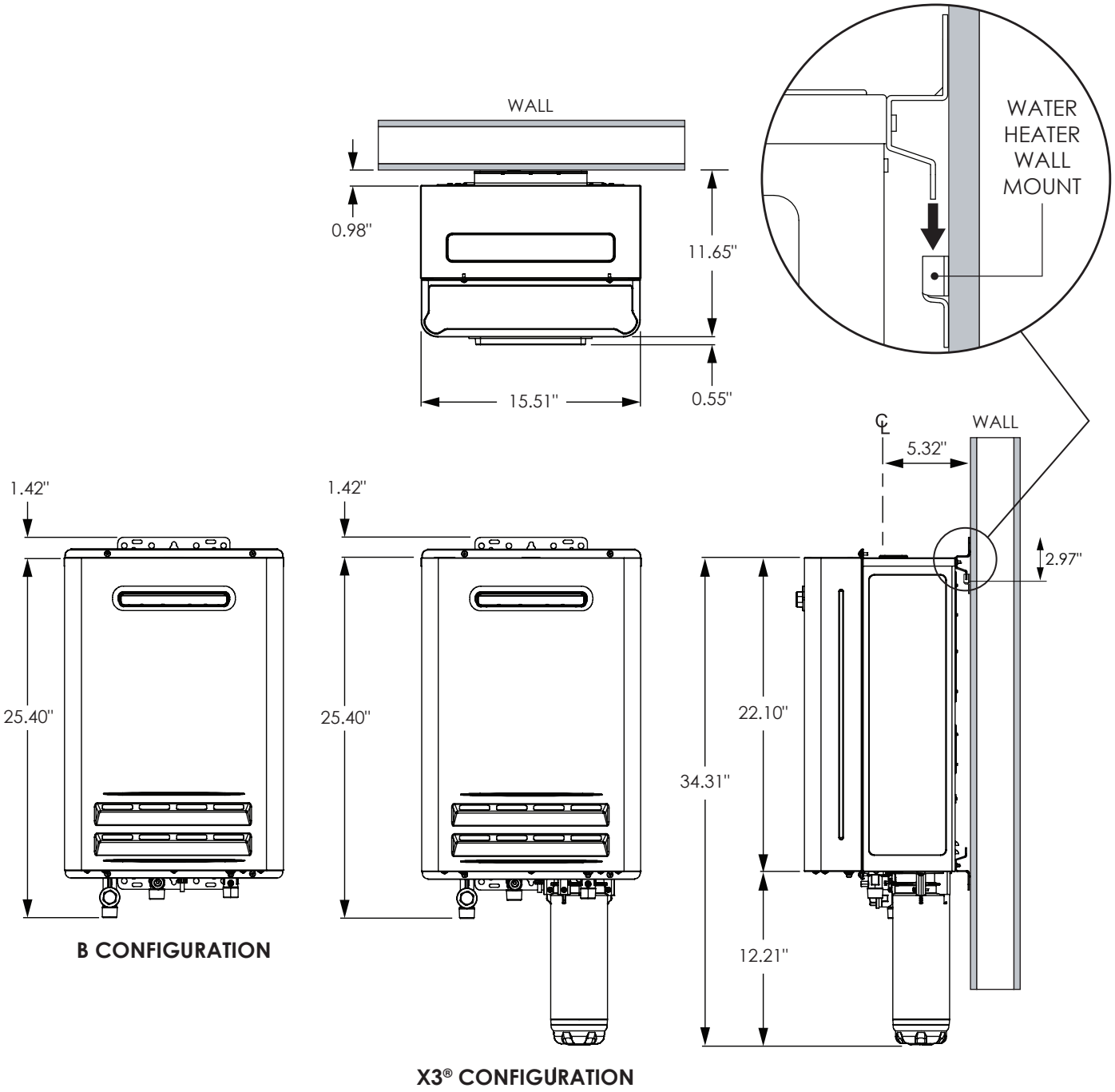
Dimensions (Indoor Model)



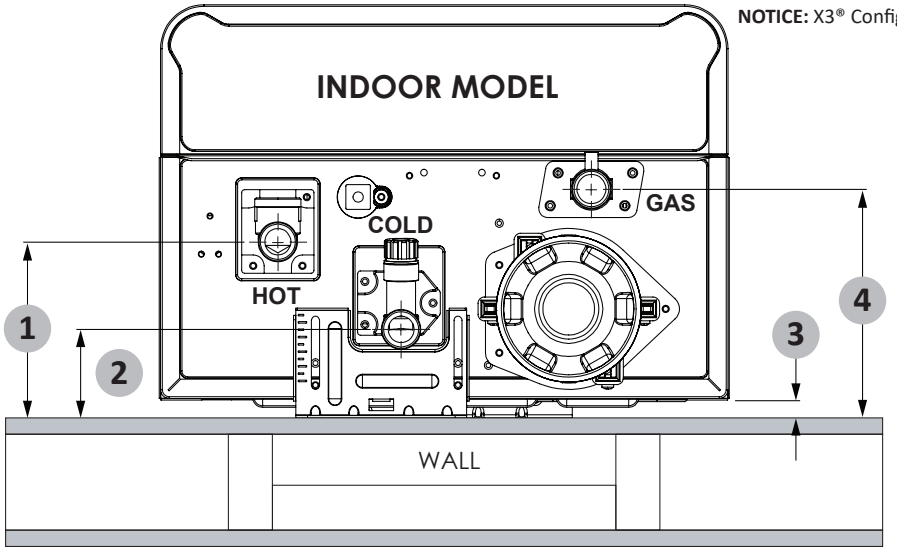
B CONFIGURATION

X3® CONFIGURATION

Dimensions (Outdoor Model)



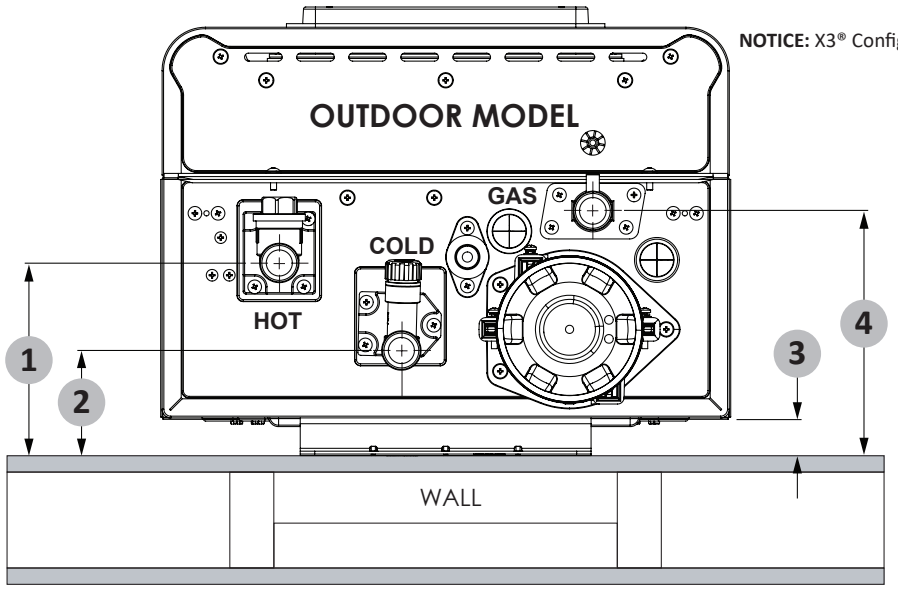
Supply Connections



NOTICE: X3® Configuration is shown.

Table 1: Supply Connections (Indoor Model)

Item	Description	Dimension (Bracket Retracted)	Dimension (Bracket Extended)	Connection Size
1	Hot Outlet	4.74 in	6.49 in	3/4" MNPT
2	Cold Inlet	2.38 in	4.13 in	3/4" MNPT
3	Wall Bracket	0.48 in	2.23 in	N/A
4	Gas Inlet	6.15 in	7.90 in	3/4" MNPT



NOTICE: X3® Configuration is shown.

Table 2: Supply Connections (Outdoor Model)

Item	Description	Dimension	Connection Size
1	Hot Outlet	5.2 in	3/4" MNPT
2	Cold Inlet	2.84 in	3/4" MNPT
3	Wall Bracket	0.98 in	N/A
4	Gas Inlet	6.62 in	3/4" MNPT

Product Specification and Technical Data (Indoor Model)

X3® Models: Comes with the X3® Scale Prevention Technology cartridge and pressure relief valve.

B Models: The base non-condensing model with no integrated X3® cartridge.

Table 3: Specifications

Model		TI-180	TI-199
Natural Gas Input (Minimum Operating Range)	BTU/H	10,000	
Natural Gas Input (Maximum Operating Range)	BTU/H	180,000	199,000
Gas Connection		3/4" NPT	
Water Connections		3/4" NPT	
Water Pressure*	psi	15 - 150	
Water Flow Rate**	gpm	0.26 - 10.0, Activation Min: 0.4	0.26 - 10.5, Activation Min: 0.4
Natural Gas Inlet Pressure	inch W.C.	Min: 4.0 Max: 10.5	
Weight	lbs.	65	
Dimensions (X3® Models)	inch	W 15.51 x H 36.88 x D 10.63	
Dimensions (B Models)		W 15.51 x H 27.92 x D 10.63	
Ignition		Electronic Ignition	
Electric Supply		120 V, 60 Hz, <5 A	
Water Heater Category* **		N/A	

*40 psi or above is recommended for maximum flow.
**Minimum activation flow rate may increase if energy demand required is below the minimum input rating of the water heater.
***Water Heater Category** - does not apply to Direct Vent water heaters and installations in manufactured homes or outdoor installations.

NOTES:

- Check the rating plate to ensure that this product matches your specifications. This water heater is designed for Natural Gas only.
- The manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligation.

Product Specification and Technical Data (Outdoor Model)

X3® Models: Comes with the X3® Scale Prevention Technology cartridge and pressure relief valve.

B Models: The base non-condensing model with no integrated X3® cartridge.

Table 4: Specifications

Model		TO-180	TO-199
Natural Gas Input (Minimum Operating Range)	BTU/H	10,000	
Natural Gas Input (Maximum Operating Range)	BTU/H	180,000	199,000
Gas Connection		3/4" NPT	
Water Connections		3/4" NPT	
Water Pressure*	psi	15 - 150	
Water Flow Rate**	gpm	0.26 - 10.0, Activation Min: 0.4	0.26 - 10.5, Activation Min: 0.4
Natural Gas Inlet Pressure	inch W.C.	Min: 4.0 Max: 10.5	
Weight	lbs.	64	
Dimensions (X3® Models)	inch	W 15.51 x H 34.31 x D 11.65	
Dimensions (B Models)		W 15.51 x H 25.40 x D 11.65	
Ignition		Electronic Ignition	
Electric Supply		120 V, 60 Hz, <5 A	
Water Heater Category* **		N/A	

*40 psi or above is recommended for maximum flow.
**Minimum activation flow rate may increase if energy demand required is below the minimum input rating of the water heater.
***Water Heater Category** - does not apply to Direct Vent water heaters and installations in manufactured homes or outdoor installations.

NOTES:

- Check the rating plate to ensure that this product matches your specifications. This water heater is designed for Natural Gas only.
- The manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligation.

IMPORTANT SAFETY INFORMATION

Read and follow all safety messages and instructions in this manual.



This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible property damage, serious injury or death. Do not remove any permanent instructions, labels, or the rating plate from either the outside of the water heater or on the inside of the access panels. Keep this manual near the water heater.

⚠ DANGER	**DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.**
⚠ WARNING	**WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.**
⚠ CAUTION	**CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.**
NOTICE	**NOTICE indicates practices not related to physical injury.**

⚠ WARNING! If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death. Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

An odorant is added by the gas supplier to the gas used by this water heater. This odorant may fade over an extended period of time. Do not depend upon this odorant as an indication of leaking gas. We recommend installing a fuel gas and carbon monoxide detector.

This product is certified to comply with a maximum weighted average of 0.25% lead content as required in some areas.

Important information to keep

Fill out this section and keep this manual in the pocket of the water heater for reference.

Date Purchased:

_____

Model Number:

_____

Serial number:

_____

Maintenance performed:*	Date:

**Operate the Pressure Relief Valve annually and inspect Pressure Relief Valve every 2-4 years (see the label on the Pressure Relief Valve for maintenance schedule). If no label is attached to the Pressure Relief Valve, follow the instructions in the Maintenance section of this manual. See the Regular Maintenance section for more information about maintaining this water heater.*

IMPORTANT SAFETY INFORMATION

To reduce the risk of property damage, serious injury or death, read and follow the precautions below, all labels on the water heater, and the safety messages and instructions throughout this manual.

RISKS DURING INSTALLATION AND MAINTENANCE



Lifting Risk

⚠ WARNING! The water heater is heavy. Follow these precautions to reduce the risk of property damage, injuries from lifting or impact injuries from dropping the water heater.

- Use at least two people to lift the water heater.
- Be sure you both have a good grip before lifting.
- Use an appliance dolly or hand truck to move the water heater.



Explosion Risk

⚠ WARNING! This water heater is designed for Natural Gas operation only. Refer to the water heater's rating plate. Failure to follow these instructions can result in serious injury or death from explosion, fire or carbon monoxide poisoning.

- **DO NOT** connect this Natural Gas water heater to an L.P. gas supply.
- Use a new gas supply line approved for Natural Gas that meets local and state codes.
- Install a full port shut-off valve on the gas supply line.
- Maintain the Pressure Relief Valve properly. Follow the maintenance instructions provided by the manufacturer of the Pressure Relief Valve (label attached to Pressure Relief Valve). If no label is attached to the Pressure Relief Valve, follow the instructions in the Pressure Relief Valve Maintenance section of this manual. An explosion could occur if the Pressure Relief Valve or discharge pipe is blocked. Do not cap or plug the Pressure Relief Valve or discharge pipe.

Gas Pressure

⚠ WARNING! The Natural Gas supply pressure must not exceed the maximum supply pressure as stated on the water heater's rating plate. Have a qualified person (licensed plumber, gas company personnel, or authorized service technician) check for proper gas pressure. Gas pressures exceeding the maximum supply pressure as stated on the water heater's rating plate can result in serious injury or death from explosion or fire.

RISKS DURING OPERATION



Scalding Risk

This water heater can make water hot enough to cause severe burns instantly, resulting in severe injury or death.

- Feel water before bathing or showering.
- To reduce the risk of scalding, install Thermostatic Mixing Valves (temperature limiting valves) at each point-of-use. These valves automatically mix hot and cold water to limit the temperature at the tap. Mixing valves are available at your local plumbing supplier. Follow the manufacturer's instructions for installation and adjustment of the valves.
- Water temperatures over 125°F can cause severe burns instantly or death from scalding. The water temperature is set at 120°F from the factory to minimize any scalding risk. Before bathing or showering, always check the water temperature. Higher temperatures increase the risk of scalding, but even at 120°F, hot water can scald. If you choose a higher temperature setting, Thermostatic Mixing Valves located at each point-of-use are particularly important to help avoid scalding.

Table 5: Scalding Table

Temperature	Time to Produce a Serious Burn
120°F (49°C)	More than 5 minutes
125°F (52°C)	1½ to 2 minutes
130°F (54°C)	About 30 seconds
135°F (57°C)	About 10 seconds
140°F (60°C)	Less than 5 seconds
145°F (63°C)	Less than 3 seconds
150°F (66°C)	About 1½ seconds
155°F (68°C)	About 1 second

For more information about changing the factory temperature setting, refer to the "Temperature Settings" section in this manual on page 49.

- Water temperature will be hotter if someone adjusted the set temperature to a higher setting.
- Should overheating occur or the burner fail to shut off, turn off the manual gas supply valve to the water heater and call a qualified person.

To reduce the risk of unusually hot water reaching the fixtures in the house, install Thermostatic Mixing Valves at each point-of-use.

If anyone in your home is at particular risk of scalding (for example, the elderly, children, or people with disabilities) or if there is a local code or state law requiring a certain water temperature at the hot water tap, these precautions are particularly important.

According to a national standard American Society of Sanitary Engineering (ASSE 1070) and most local plumbing codes, the water heater's thermostat should not be used as the sole means to regulate water temperature and avoid scalds.

Water Contamination Risk

Do not use chemicals that could contaminate the potable water supply. Do not use piping that has been treated with chromates, boiler seal, or other chemicals. Suitable for potable water heating only.



Fire Risk

To reduce the risk of a fire that could result in property damage, or serious injury or death:

- Do not store things that can burn easily such as paper or clothes next to the water heater.
- Do not store or use gasoline or other flammable substances in the vicinity of this or any other appliance.
- Do not use this appliance if any part has been in contact with or been immersed in water. Immediately call a qualified installer or service agency to replace a flooded water heater. Do not attempt to repair the unit. It must be replaced.



Explosion Risk

High pressures in the water heater can cause an explosion resulting in property damage, serious injury or death. A Pressure Relief Valve is required to be installed on the water heater. A Pressure Relief Valve is supplied with X3® models and shall be field supplied for B models. Additional pressure protective equipment may be required by local codes.

A nationally recognized testing laboratory maintains public inspection of the valve production process and certifies that it meets the requirements for Relief Valves for Hot Water Supply Systems, ANSI Z21.22. The Pressure Relief Valve's relief pressure must not exceed the working pressure rating of the water heater as stated on the rating plate.

Carbon Monoxide Risk



⚠ WARNING! This water heater operates by burning gas. Carbon monoxide is a colorless, odorless, gas that is a by-product of burning of fuels such as coal, wood, charcoal, oil, kerosene, propane, and natural gas. Breathing excessive and abnormal amounts of carbon monoxide can cause carbon monoxide poisoning, resulting in serious injury or death. This water heater must be supplied with adequate combustion air and must be properly vented to the outdoors. Have a qualified person (licensed plumber, authorized gas company personnel, or authorized service technician) install the venting system using these installation instructions.

Install a fuel gas and carbon monoxide detector in the living areas of your home.

Failure to follow these instructions can result in serious injury or death from carbon monoxide poisoning.

Read Before Installation

1 Review all of the instructions before you begin work. Improper installation can damage the water heater, your home and other property, and can present risks of serious injury or death.

2 The Indoor water heater is designed for a concentric venting system which uses a one pipe system with two ducts for combustion air and exhaust air. The outdoor water heater is designed for outdoor installation only. This water heater must be installed:

- Following all local codes, or in the absence of local codes, follow the current edition of ANSI Z223.1/NFPA 54, National Fuel Gas Code.
- For installation in manufactured homes (mobile homes) follow the current edition of The Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280 and/or CSA Z240 MH Series, Manufactured Homes.
- Follow the electrical code requirements of the local authority having jurisdiction. In the absence of such requirements, follow the current edition of the National Electrical Code ANSI/NFPA 70.

This is available from the following:

CSA Group, Inc.
United States:
8501 East Pleasant Valley Road
Cleveland, OH 44131

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269

Check with local code officials about codes governing this installation. Have your installation inspected by a code official to ensure the installation meets all local codes.

NOTICE: Installation and service must be performed by a qualified installer (for example, a licensed plumber or gas fitter). Otherwise, the warranty will not apply. The installer (licensed professional) is responsible for the correct installation of the water heater and for compliance with all national, state and local codes.

Massachusetts code requires this water heater to be installed in accordance with Massachusetts 248-CMR 2.00 and 248-CMR 5.00: State Plumbing Code. Other local and state authorities may have similar requirements or other codes applicable to the installation of this water heater.

3 Before you start, be sure to check the following:

⚠ WARNING! Do not store or use flammable materials, vapors, or liquids in the same location where this water heater is installed.

- All gas water heaters require correct installation to ensure safe and efficient operation. This manual must be followed exactly. Read the entire manual before installation and review the "Important Safety Information" section (see page 13).
- Carefully plan the installation location of the heater and vent terminations.
- The water heater must be installed where the proper amount of combustion air will be available to it at all times without obstructions. The water heater must be direct vented.
- The length of piping between the water heater and fixture determines the time it takes for the hot water to arrive. Consider installing the water heater closer to fixtures if the plumbing system allows for it. The water heater should be the first appliance to access the water line after the utility water meter.
- Locate your water heater close to a drain where water leakage will not do damage to surrounding areas. As with any water heating appliance, the potential for leakage at some time in the life of the product does exist. A drain pan, or other means of protection against water damage, is recommended to be installed under the water heater in case of leaks to lessen the chance of sustaining property damage. In addition, you may install an active water leak detector with a shutoff valve which can turn off the water supply in the event of a leak. The manufacturer is not responsible for damage due to water leaks.
- The water heater shall be securely wall-mounted or mounted on a stand.
- Maintain proper space for servicing. Install the unit so that it can be connected or removed easily. Refer to the "Unit Clearances" section for proper clearances (see page 22).

NOTICE: For outdoor installations, locate the water heater in an open, unroofed area. Maintain 3 inches minimum clearance from the left and right sides of the unit.

- The manufacturer does not recommend installing the water heater in an attic due to safety issues. See the installation section for further information.

⚠ WARNING! Failure to observe these warnings could result in severe personal injury, death, and/or property damage.

Venting/Combustion

- **DO NOT** install the water heater where water, debris or flammable vapors may get into the flue terminal. This may cause damage to the water heater and the warranty will not apply.
- **DO NOT** locate your heater in a pit or location where gas and water can accumulate.
- **DO NOT** install the exhaust vent within 3 feet of an overhang. Vent termination must be at least 2 ft away from an inside or outside corner for direct vent and other than direct vent installations (see Figure 1 & Figure 2 for indoor and outdoor models, respectively).
- **DO NOT** install the unit where the exhaust vent is pointing into any opening in a building or where the noise may disturb your neighbors. Make sure the vent termination meets the required clearance from any doorway or opening to prevent exhaust from entering a building. Check local code requirements prior to installation (see Figure 3 & Figure 4 for indoor and outdoor models, respectively).
- **DO NOT** install next to a dryer or any source of airborne debris that can be trapped inside the combustion chamber unless the system is direct vented. When direct vented, do not install the air intake near the dryer vent or any source of airborne debris.
- **DO NOT** common vent the indoor water heater with any other water heaters or appliances.

Outdoor Applications (Outdoor Model Only)

The Outdoor models are only to be installed outdoors and only in an area with mild, temperate climates. The Outdoor model shall be wall mounted, on a stand, or installed in an approved recess box. Locate the Outdoor model in an open, unroofed area and maintain the minimum clearances from the water heater exhaust terminal (see Figure 2 & Figure 4).

NOTICE: The water piping external to the water heater is not protected by the Freeze Protection system. If installed in an area subject to freezing temperatures, it is suggested that pipe insulation be installed on the external water piping.

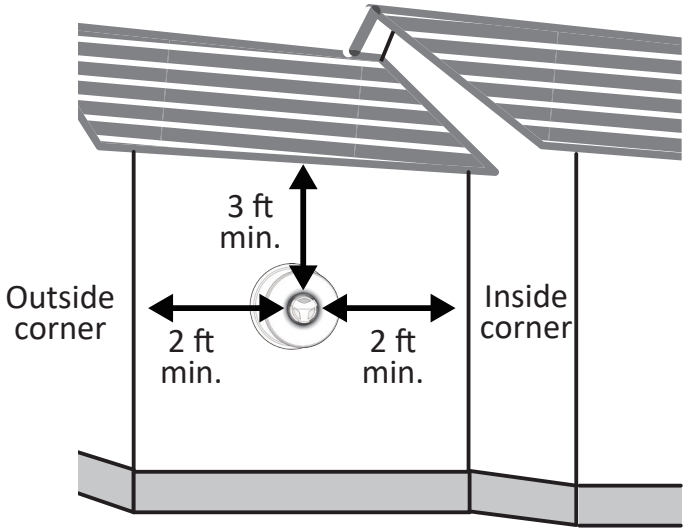


Figure 1 - Overhang and Inside Corner Restrictions (Indoor Direct Venting)

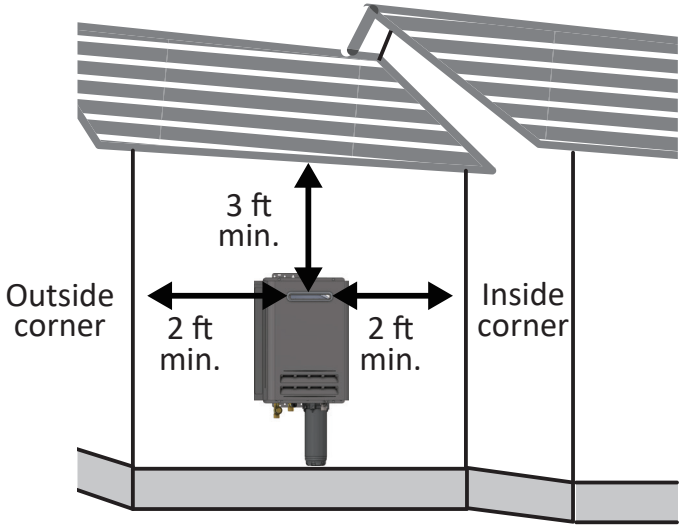


Figure 2 - Overhang and Inside Corner Restrictions (Outdoor Other than Direct Venting)

Venting/Combustion (Indoor Model)

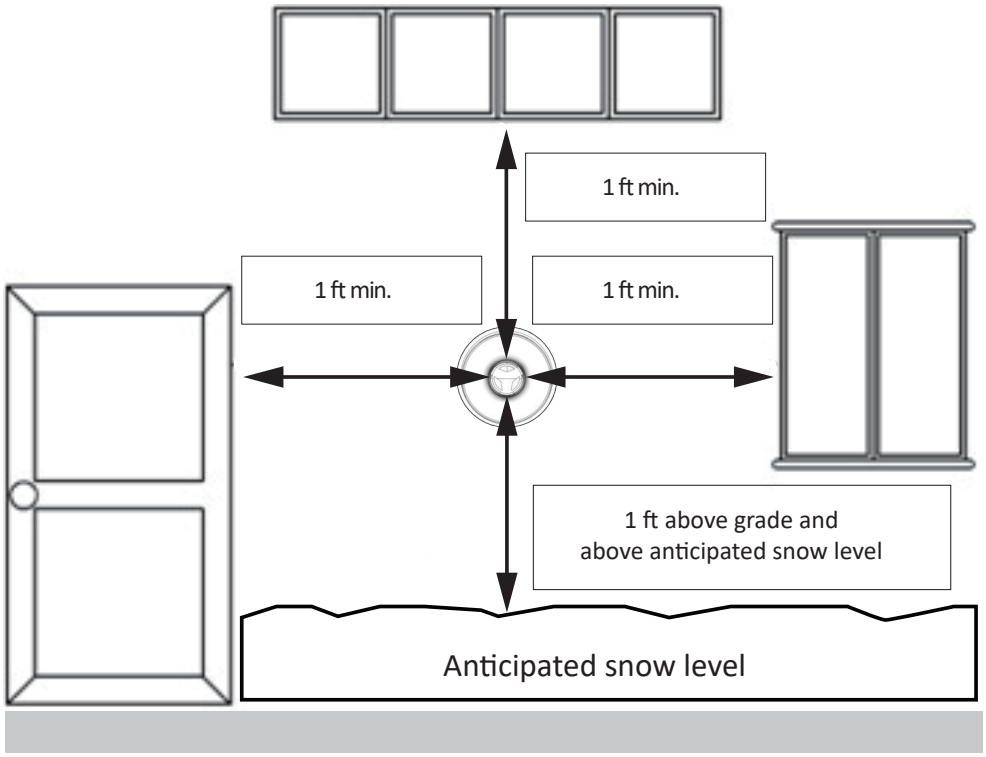


Figure 3 - Minimum Vent Clearance (Indoor Direct Venting)

Venting/Combustion (Outdoor Model)

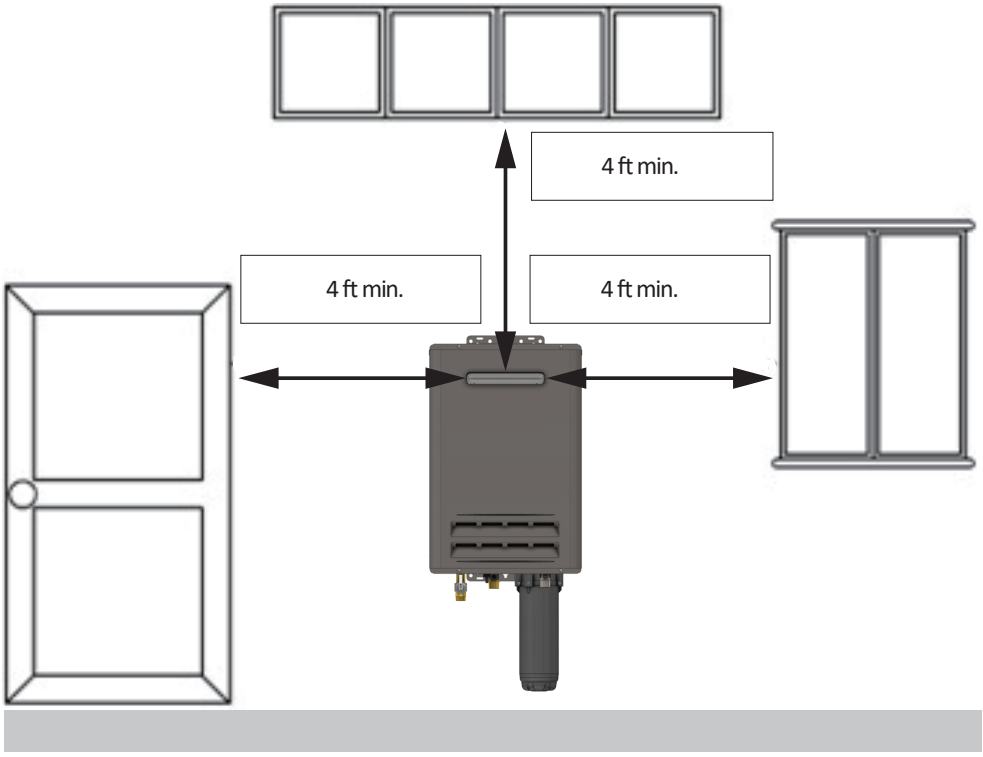


Figure 4 - Minimum Vent Clearance (Outdoor Other than Direct Venting)

Recommended Tools and Materials

Before you start, be sure you have the following tools and supplies:

- Plumbing tools and supplies appropriate for the type of water pipes in your home.
- Thread sealant tape or pipe joint compound approved for potable water.
- Pipe dope approved for gas connections or gas type.
- For homes with water lines using threaded connectors suitable for the specific type of plastic pipe used: CPVC or PEX (cross-linked polyethylene). Do not use PVC pipe.
- Non-corrosive gas leak detection solution made from hand dishwashing soap mixed with water (1 part soap to 15 parts water) or children's soap bubbles and a small, soft-bristled brush or approved gas leak detection device.
- An appliance dolly or hand truck to move the water heater.

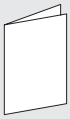
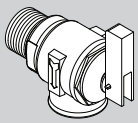
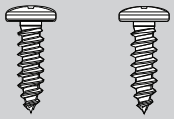
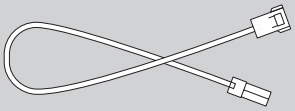
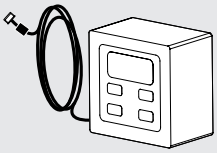
Recommended Accessories

- Automatic water leak detection and shut-off device
- Thermostatic Mixing Valves at each point-of-use
- Fuel gas and carbon monoxide detector

GETTING STARTED

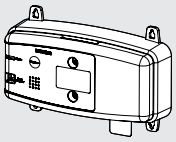
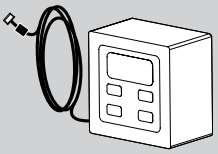
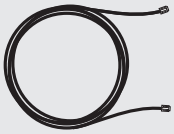
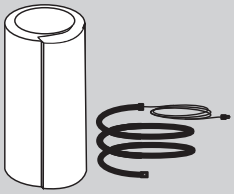
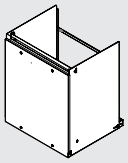
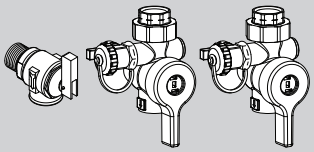
Included Items

Table 6: Items Included with your Water Heater

Item	Product Image	Description	Configuration	
			X3	B
Manual		Installation Instructions and Use & Care Guide for TI Indoor & TO Outdoor series model water heaters.	√	√
Pressure Relief Valve		Pressure Relief Valve rated up to 150 psi and the maximum BTU/hr of the water heater. (Included with X3® models; Field supplied for B models)	√	
X3® Cartridge		Prevents scale buildup and eliminates the need for annual descaling maintenance.	√	
Screws for Vent Collar		Screws to secure the vent piping to the vent collar. See instructions provided with ventilation kit. • 3/16 in x 1/2 in Vent Screw (2x)	√	√
Cartridge Screws		Screws to secure the X3® Cartridge: • M4-12 mm (1x) • M4-25 mm (2x) (Not applicable to B models)	√	
Cascading Cable		Cascading Cable for electronically connecting tankless water heaters in series for greater output: • P/N 100371915	√	√
Remote Controller (TO Only)		Remote Controller with 10 ft. cable. Provided with TO Outdoor series model water heaters only. **NOTICE:** Only 1x remote controller can be used with this water heater.	√	√

Available Accessories

Table 7: Accessories Available for your Water Heater

Item	Description	
Wi-Fi Module		Wi-Fi Module for electronically connecting tankless water heaters to the internet and adapter to connect to the water heater: • P/N 100371922
Remote Controller		Remote Controller with 10 ft. cable: • P/N 100383909 **NOTICE:** Only 1x remote controller can be used with this water heater.
Communication Cables		Communication Cable Extensions for Remote Controller, Wi-Fi Module, or On-Demand Receiver: • P/N 100377341 for 10 ft. (3 m) • P/N 100377342 for 32 ft. (10 m)
Cartridge Freeze Protection		Cartridge Freeze Protection can add an extra layer of freeze protection to external cartridge: • P/N 100325654 for X3® models
Pipe Cover		Pipe Cover protects plumbing connections to the heater while improving the appearance of the installation. Affixes to bottom of heater: • P/N 100387711
Isolation Valve Kit with Pressure Relief Valve		Isolation Valve supports routine maintenance and allows for draining and flushing the heater; whereas, the Pressure Relief Valve, as the name implies, serves to limit internal pressure in the system: • P/N 100112156

Installation Environment

Proper Mounting and Clearance

The water heater shall be securely mounted on a wall that can support the weight of the water heater. Adjustable mounting brackets are provided on the water heater cabinet to securely mount the water heater to the appropriate wall construction. The water line, gas line, vent condensate drain line (if installed), and pressure relief valve discharge line shall be supported using field supplied pipe hangers. The water heater shall not bear the weight of these lines. The water heater requires proper installation clearance for operation and service as described in "Unit Clearances" on the right.

⚠ WARNING! The installer (licensed professional) is responsible for the correct installation of the water heater and for compliance with all national, state and local codes.

Atmosphere Temperature (Indoor Model)

Install the indoor water heater in a heated area where below freezing temperatures cannot occur. The warranty will not be covered if the water heater is damaged due to freezing. See "Freeze Protection System" on page 52

Atmosphere Temperature (Outdoor Model)

The outdoor models are only to be installed outdoors and only in an area with mild, temperate climates. The outdoor model shall be wall mounted or on a stand. Locate the Outdoor model in an open, unroofed area and maintain the minimum clearances (see the "Venting/Combustion" section on page 17 and Figure 6 on the right).

NOTICE: The water piping external to the water heater is not protected by the Freeze Protection system. If installed in an area subject to freezing temperatures, it is suggested that pipe insulation be installed on the external water piping.

Combustion Air Supply (Indoor Model)

The water heater requires fresh combustion air and should be free of corrosive elements and flammable vapors. The indoor water heater **MUST** be direct vented for all installations.

Proper Ventilation

For proper operation the water heater must be vented in accordance with the section "Venting" of the current edition of the ANSI Z223.1/NFPA 54, National Fuel Gas Code, as well as applicable local building codes.

Vent Drain Line

The condensate produced is acidic. Drain the condensate in accordance with all local codes and common safety practices.

Unit Clearances

⚠ WARNING! Maintain all clearances around the water heater. Failure to do so could create a fire hazard, potentially leading to death, serious injury, and/or property damage.

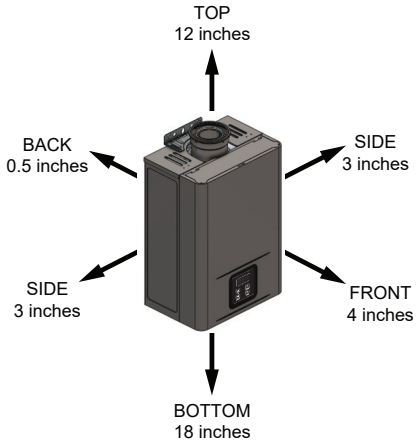


Figure 5 - Indoor Clearances

NOTICE: It is recommended for Indoor models that the front should have 24 inches of clearance for maintenance.

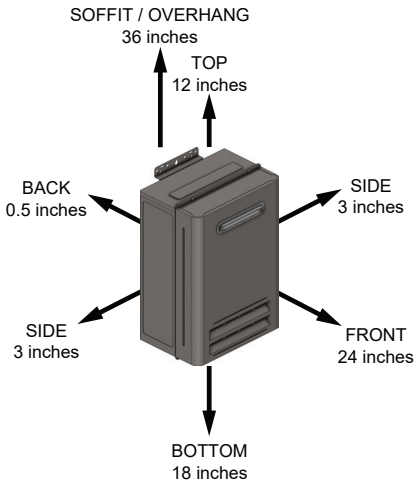


Figure 6 - Outdoor Clearances

NOTICE: Outdoor water heaters must be at least 36 inches away from a ventilated or unventilated soffit or eave vent; or to a deck or porch.

Mounting the Water Heater (Indoor Model)

Secure the water heater firmly, fastening appropriate screws for wall construction into the upper and bottom brackets of the water heater and wall. Make sure top and bottom water heater brackets are level. **DO NOT** secure to drywall only. See Figure 7.

NOTICE: These screws are not provided with the water heater. Use fasteners approved for the appropriate wall material/ construction. Make sure to level the bracket.



Figure 7 - Use Mounting Screws to Secure Water Heater to Wall Construction

IMPORTANT: The brackets are extendable up to 1.16" and **MUST** be secured with the two screws provided on each side. See Figure 8.

⚠ WARNING! Failure to properly secure extendable mounting brackets could create a gas and fire hazard, potentially leading to death, serious injury, and/or property damage.

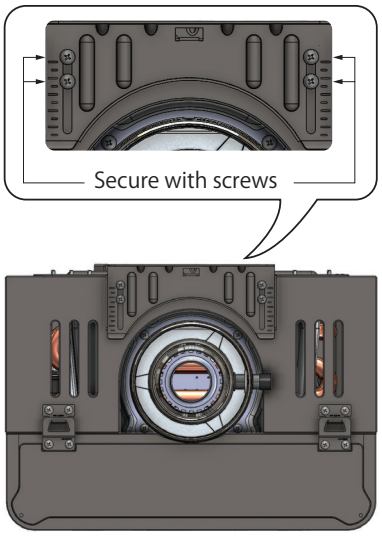


Figure 8 - Verify Bracket is Secured with Screws

Mounting the Water Heater (Outdoor Model)

1 Secure the wall mounting bracket to an exterior wall. As an example, Figure 9 shows the wall mounting bracket installed to masonry.

NOTICE: The supplied fasteners are lag bolts for wood studs only. When mounting on any other surface, use fasteners approved for that wall material/construction. Make sure to level the bracket.

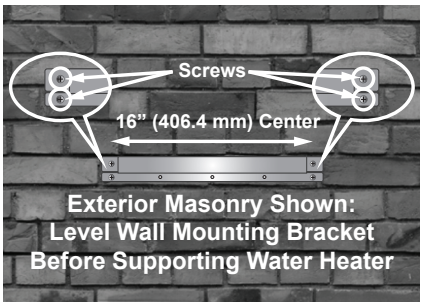


Figure 9 - Wall Bracket Installation

2 Hang the heater on the mounting bracket (Figure 10).

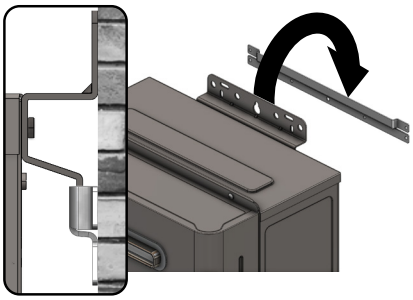


Figure 10 - Hang Water Heater on Wall Bracket

3 Secure the water heater firmly, fastening the appropriate screws for wall construction into the upper and bottom brackets of the water heater and wall. See Figure 11.

NOTICE: These screws are not provided with the water heater. Use fasteners approved for the appropriate wall material/ construction. Make sure to level the bracket.

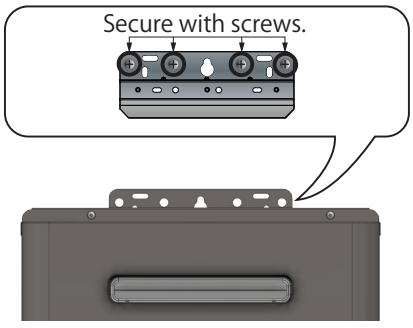


Figure 11 - Use Mounting Screws to Secure Water Heater to Wall Construction

Venting (Indoor Model)

⚠ WARNING! Carbon Monoxide Hazard. This water heater must be supplied with adequate air and vented to outdoors. The vent system must be installed by a qualified person. Examples of a qualified person include gas technicians, authorized gas company personnel, and authorized service technicians. Failure to properly vent the water heater can result in severe injury or death from carbon monoxide poisoning.

The water heater must be vented in accordance with the current edition of ANSI Z223.1/NFPA 54, National Fuel Gas Code, as well as applicable local building codes.

The water heater is designed for a concentric venting system, which uses a one pipe system with two ducts for combustion air and exhaust air.

The manufacturer approves the use of several venting systems on new installations. This system is furnished through the heater manufacturer or distributors. See Table 8 on page 26 for approved vent terminations and systems.

If existing venting and vent terminations are used, see "Replacing a Water Heater Using the Existing Vent System" on page 25.

Venting may not intermingle with other manufacturer's venting or material type, other than approved appliance adapters.

Approved Appliance Adapters:

The water heater's flue collar will accept CoxCentric®, Centrotherm Eco Systems Direct Vent APNC35 and Ubbink venting without the need for an appliance adapter. Metal-Fab Corr/Guard® venting will require an approved appliance adapter to be inserted into the water heater's flue collar. See Table 8 for approved appliance adapters.

General Rules for Venting Water Heaters:

- Follow the vent pipe's manufacturer's instructions when installing the vent pipe.
- Place the water heater as close as possible to the vent termination.
- **DO NOT** weld, glue or permanently bond the vent pipe to the water heater's vent collar.
- **DO NOT** cut or alter the vent collar of the unit.
- The vent must be easily removable from the top of the water heater for normal service and inspection of the unit and vent system.
- The venting is approved for zero (0") clearance to combustibles and non-combustibles.
- Avoid using an oversized vent pipe or using extremely long runs of the pipe.
- **DO NOT** common vent or connect any vent from other appliances to the water heater vent.
- The water heater shall not be connected to a chimney flue serving a separate appliance, designed to burn solid fuel.

General Rules for Vent Terminations:

- Avoid locating the water heater vent termination near any air intake devices. These fans can pick up the exhaust flue products from the water heater and return them to the building. This can create a health hazard.
- Locate the vent termination so that it cannot be blocked by any debris, at any time. Most codes require that the termination be at least 12 inches above grade and anticipated snow level, but the installer may determine if it should be higher depending on the job site condition and applicable codes.
- To reduce the risk of carbon monoxide poisoning, install a fuel gas and carbon monoxide detector. Install and maintain the detector in accordance with the manufacturer's instructions and local codes.

Installing Sidewall Termination & Blocker Plate (Metal-Fab Corr/Guard®):

Orient the sidewall termination so the air intake openings are facing downward (see Kit Instructions provided with sidewall termination).

The blocker plate provided with the Metal-Fab Corr/Guard® sidewall termination kit must be installed to ensure proper operation of the water heater. Failure to install the blocker plate to the venting system could in rare cases force exhaust gases into the combustion air supply, resulting in noisy or otherwise improper operation of the water heater.

General Rules for Condensation Traps:

- The vent should slope towards the heater and the vent collar. A condensate trap must be installed below the condensate collector's drain nipple.
- For field made traps using tubing, make sure the trap loop has sufficient water to prevent exhaust gases from entering the installation space before operating the water heater. **DO NOT** operate the water heater if the trap does not have sufficient water. Inspect the drain line yearly for any damage and for sufficient water in the trap loop.
- This venting component must be installed in roof top terminations and when horizontal terminations exceed 8 ft. of equivalent vent length, excluding the sidewall termination. Condensate is corrosive and should be treated and disposed of according to local codes. See Figure 12 & Figure 13.

Replacing a Water Heater Using the Existing Vent System

⚠ WARNING! Improper venting of this appliance can result in excessive levels of carbon monoxide which can result in severe personal injury or death. Improper installation can cause nausea or asphyxiation, severe injury or death from carbon monoxide and flue gases poisoning. The product warranty will not apply to improper installations.

⚠ WARNING! When installing the vent system, all applicable national and local codes must be followed. If you install thimbles, fire stops or other protective devices and they penetrate any combustible or noncombustible construction, be sure to follow all applicable national and local codes.

DO NOT use Category I or Category II venting system with this water heater.

If existing venting and vent terminations are used, they **MUST** be cleared of **ALL** restrictions, such as a restrictor plate, for proper operation.

Read the entire "Venting" section of this manual and make sure your vent system is properly installed. Inspect the existing vent system for obstructions, corrosion, and proper installation. Repair or replace if necessary.

Vent Length and Number of Elbows Allowed

- For best results, a vent system should be as short and straight as possible.
- This water heater must be vented with approved concentric venting as described in Table 8 on the following page.
- Follow the vent pipe manufacturer's instructions and the instructions in this manual when installing the vent pipe.
- **DO NOT** common vent this appliance with any other vented appliance.
- **DO NOT** terminate vent inside a chimney. If the vent must go through the chimney, it must run through the top of the chimney and terminate with the roof termination listed in Table 8. Install per the vent manufacturer's instructions.
- When the horizontal vent run exceeds 5 ft., support the vent run at 3 ft. intervals with overhead hangers.
- The maximum length of exhaust vent pipe must not exceed 45 ft., deducting 5 ft. for each 90° elbow used in the venting system. See Table 9 & Table 10
- **DO NOT** use more than 4 pieces of 90° elbows.

NOTICE: If an 90° elbow connects to the vent collar directly, the connection is equivalent to 5 ft. of vent length. Be sure to calculate total vent length including the connection part as 5 ft. when using this connection.

INSTALLATION

Table 8: Acceptable Concentric Venting

Vent Brand	Description & Model Number	Part Number
CoxCentric®	Sidewall Termination Kit (13-3/4" Termination, 87° Elbow)	100399307
	Sidewall Termination Kit (28-3/4" Termination, 87° Elbow)	100399308
	Roof Termination Kit	100399342
Metal-Fab Corr/Guard®	Sidewall Termination Kit, 3CGVPHK-AO (does not include straight pipe)	100383605
	Roof Termination Kit, 3CGVPVK-AO (does not include straight pipe)	100383608
	Appliance Adapter - Vertical Applications, 3CGRLSV	100383626
Centrotherm Eco Systems Direct Vent APNC35	11-1/2" Concentric, Sidewall Termination Kit	100266115
	21" Concentric, Sidewall Termination Kit	100266117
	38" Roof Termination Kit	100266118
	18" Roof Termination Kit	100305170
Ubbink	21" Non-Condensing Horizontal Termination Diverter Kit	223187

Table 9: Acceptable Vent Length

Vent Type	Diameter	Maximum Number of 90° Elbows	Maximum Vertical & Horizontal (Total) Vent Length
Concentric	3 inch / 5 inch	4*	45 ft.

*For each 90° elbow added, deduct 5 feet from maximum vent length. Two 45° elbows are equivalent to one 90° elbow.

Table 10: Maximum Vent Length with Elbows

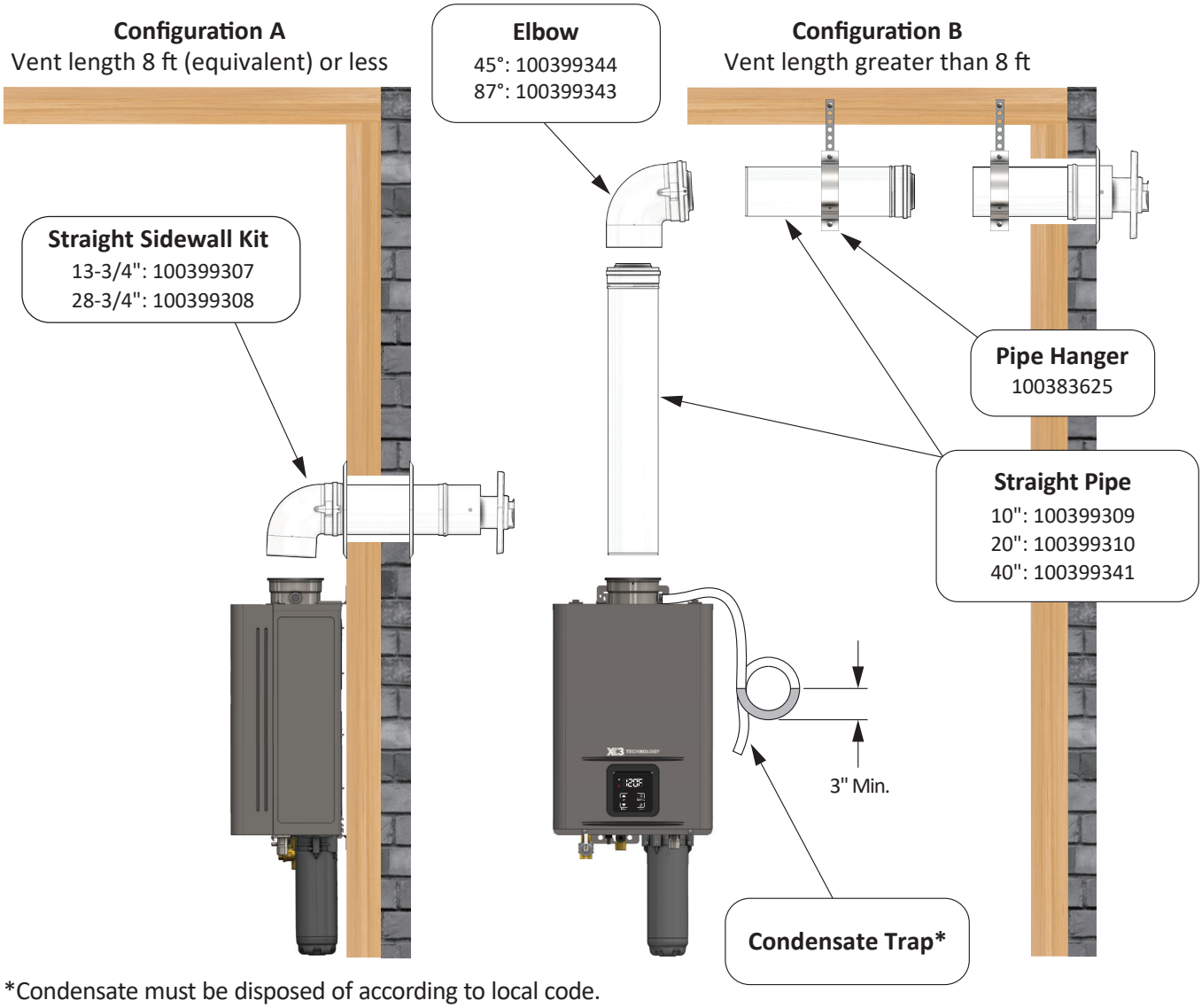
Number of 90° Elbows	Maximum Vertical & Horizontal Vent Length*
0	45 ft.
1	40 ft.
2	35 ft.
3	30 ft.
4	25 ft.

***NOTICE:** Table 10 excludes concentric termination.

Venting Illustrations

For details of the venting installation, refer to the CoxCentric®, Metal-Fab Corr/Guard® or Centrotherm Eco Systems Direct Vent APNC35 concentric venting installation manuals. See Figure 12 and Figure 13 for proper venting configurations for horizontal and vertical applications.

Horizontal Installation (CoxCentric® Shown)



*Condensate must be disposed of according to local code.
*Verify there is sufficient water in the trap loop to create barrier.

Figure 12 - Horizontal Installation

Vertical Installation (CoxCentric® Shown)

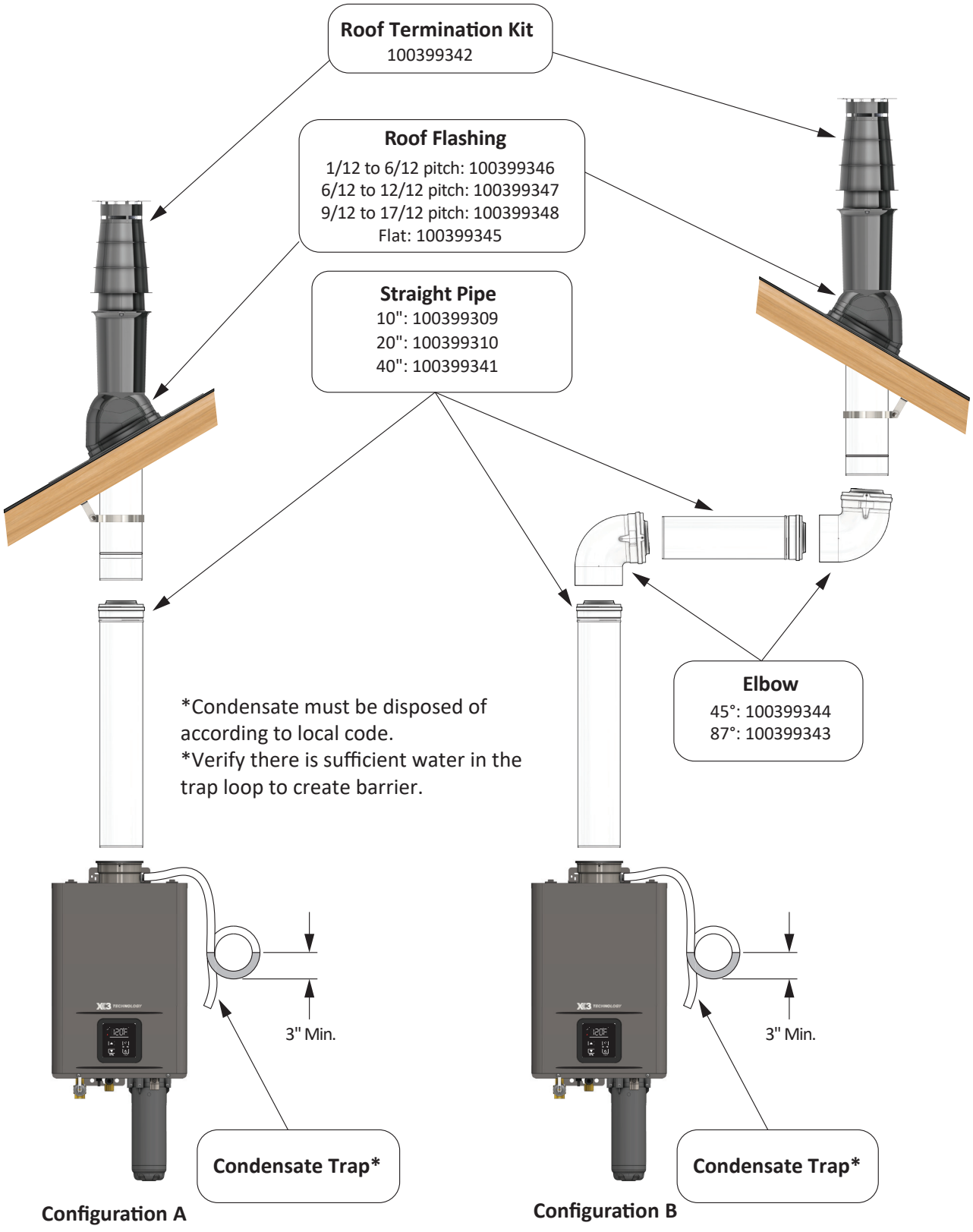


Figure 13 - Vertical Installation

Vent Termination Clearances

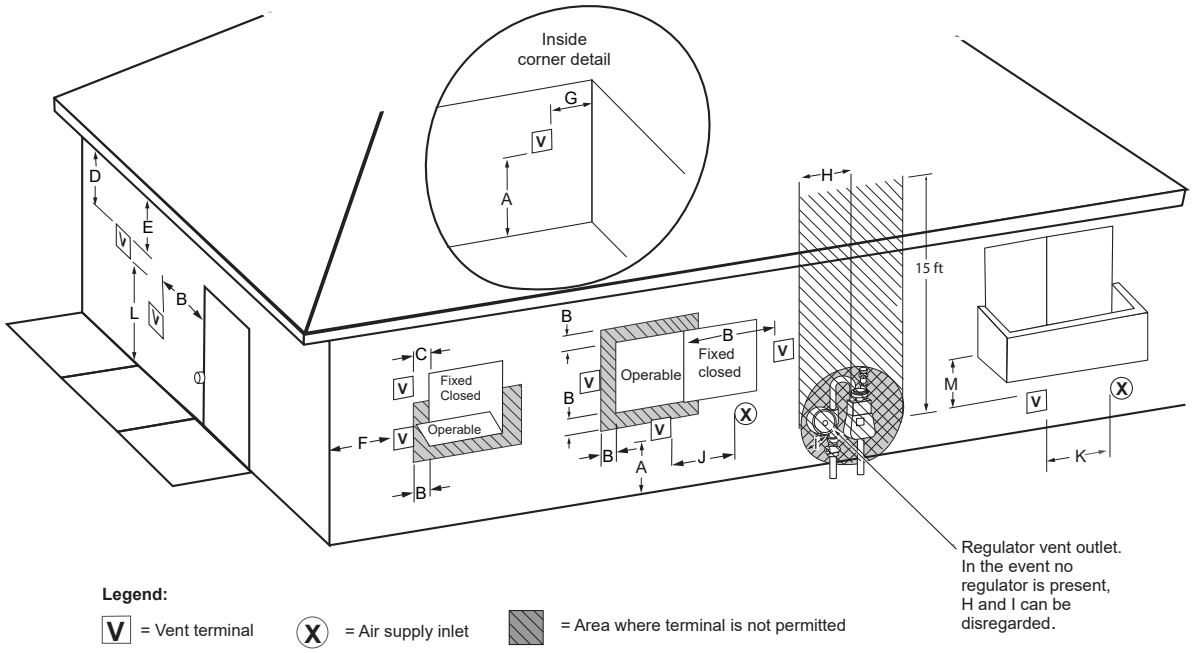


Table 11: Vent Termination Clearances

		Direct Vent	Other than Direct Vent
A	Clearance above grade, veranda, porch, deck, or balcony	1 ft (30 cm)	
B	Clearance to window or door that may be opened	1 ft (30 cm)	4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening
C	Clearance to permanently closed window	0	
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	3 ft (91 cm)	
E	Clearance to unventilated soffit	3 ft (91 cm)	
F	Clearance to outside corner	2 ft (61 cm)	
G	Clearance to inside corner	2 ft (61 cm)	
H	Clearance to each side of center line extended above meter/regulator assembly	*	
I	Clearance to service regulator vent outlet	*	
J	Clearance to non-mechanical air supply inlet to a building or the combustion air inlet to any other appliance	1 ft (30 cm)	4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening
K	Clearance to mechanical air supply inlet	3 ft (91 cm) above if within 10 ft (3 m) horizontally	
L	Clearance above paved sidewalk or paved driveway located on public property	7 ft (213 cm)**	
M	Clearance under veranda, porch deck, or balcony	1 ft (30 cm)***	

*Clearance in accordance with local installation codes and the requirements of the gas supplier.

**A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

***Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

Notes:

1) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code.
2) If locally adopted installation codes specify clearances different than those illustrated, then the most stringent clearance shall prevail.
3) Blocking air supply and exhaust vent by snow may cause incomplete combustion and an appliance failure. Install the termination by providing sufficient clearance from anticipated snow line in accordance with local code or manufacturer's instructions and make sure there is no blockage.
4) Provide an appropriate clearance between a vent termination and a building to prevent degradation to building materials caused by flue gases.

Clearances for Sidewall Terminations (Indoor Model)

⚠ WARNING! Improper installation can result in carbon monoxide poisoning or death. Follow all local and national codes in regard to proper termination clearances. In the absence of such codes, the clearances below can be used as guidelines. Local codes supersede these guidelines.

Multiple-unit concentric wall termination clearances:

- Space each concentric wall terminations at least 1 ft. away from each other, no matter the orientation. A concentric wall termination must also be at least 2 ft. away from an inside corner. If the adjacent wall is less than 2 ft. in length, the minimum required distance away from the inside corner will be equal to the length of the adjacent wall (Figure 14).
- Concentric wall terminations should be at least 3 ft. away from a ventilated or unventilated soffit. Concentric wall terminations should be at least 2 ft. away from an opposite surface or wall (Figure 15).
- **DO NOT** place the termination directly in front of an opening into a building.

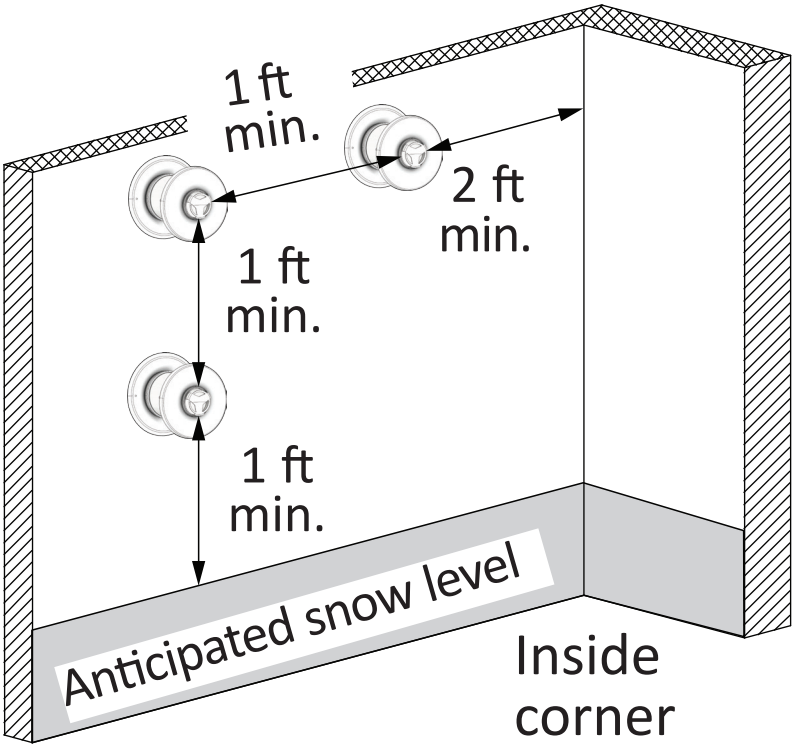


Figure 14 - Multi-Unit Concentric Wall Terminations (TI Indoor Models)

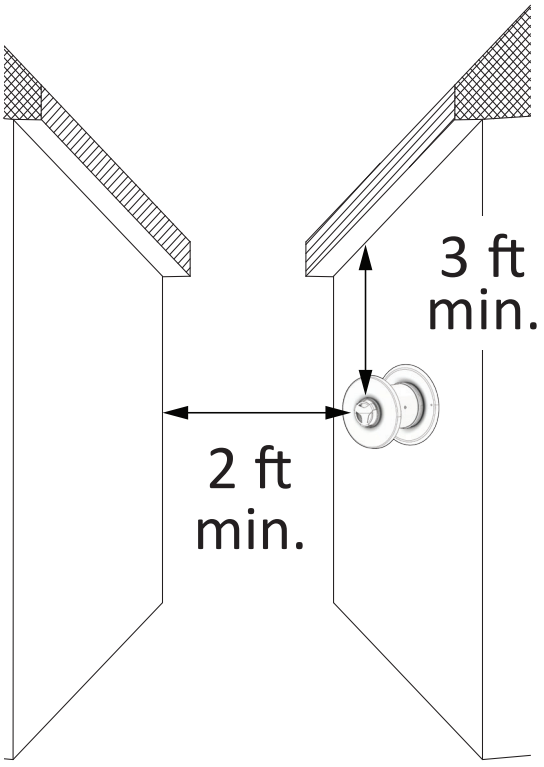


Figure 15 - Concentric Wall Termination Clearances (TI Indoor Models)

Clearances for Multi-Unit Water Heaters (Outdoor Model)

⚠ WARNING! Improper installation can result in carbon monoxide poisoning or death. Follow all local and national codes in regard to proper termination clearances. In the absence of such codes, the clearances below can be used as guidelines. Local codes supersede these guidelines.

Multiple-unit outdoor water heater termination clearances:

- Outdoor water heaters must have at least 2 inches of horizontal space between each unit. There must be at least 5 ft. of space between the exhaust terminals of each unit if the water heaters are installed vertically. The water heater exhaust terminal must also be at least 2 ft. away from an inside corner. (Figure 16).
- Outdoor water heaters must be at least 3 ft. away from a ventilated or unventilated soffit or eave vent; or to a deck or porch (Figure 16).
- **DO NOT** place the water heater directly in front of an opening into a building.

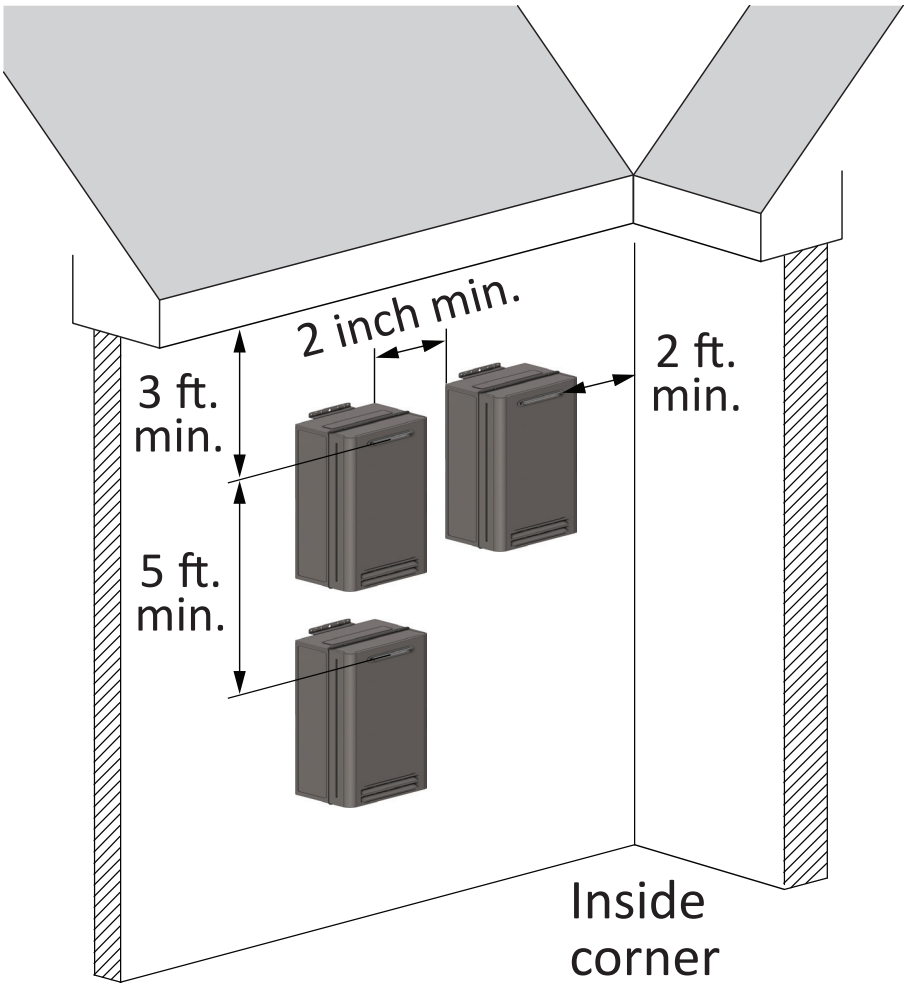


Figure 16 - Multi-Unit Outdoor Terminations (TO Outdoor Models)

Clearances for Rooftop Terminations

⚠ WARNING! Improper installation can result in carbon monoxide poisoning or death. Follow all local and national codes in regard to proper termination clearances. In the absence of such codes, the clearances below can be used as guidelines. Local codes supersede these guidelines.

Minimum spacing between multiple concentric terminations for rooftops:

- The air intake must be a vertical distance of at least 1 ft. above the anticipated snow level.
- On a different level: 5 ft. spacing between each termination (Figure 17).
- On the same level: 2 ft. spacing between each termination (Figure 18).
- The exhaust termination must be a horizontal distance of at least 2 ft. from a wall or surface unless specified differently by local code (Figure 18).

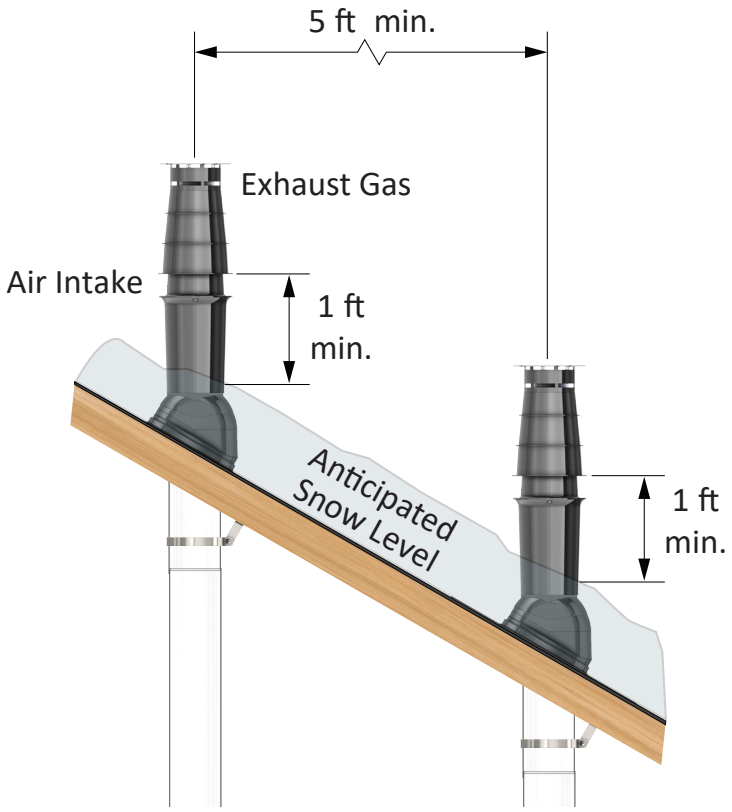


Figure 17 - Sloped Roof Termination

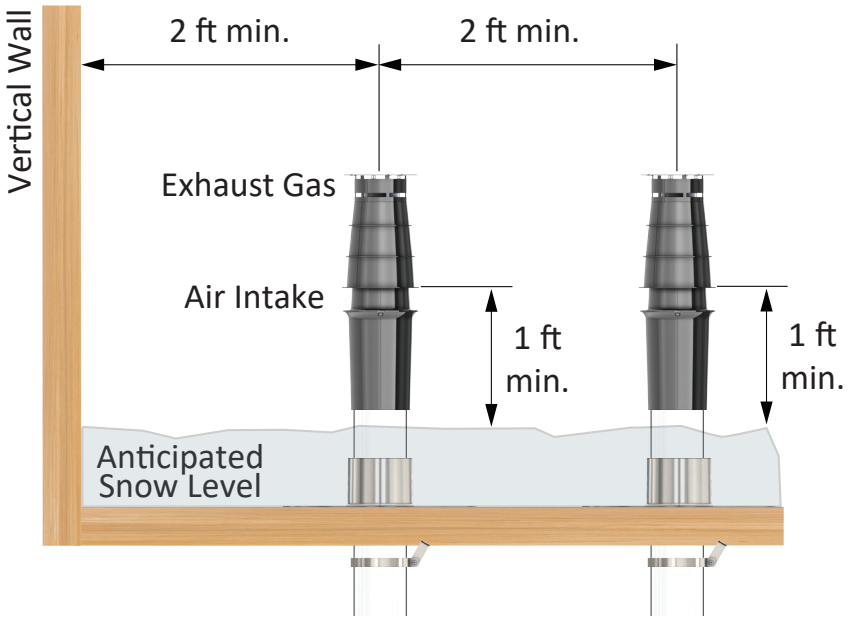


Figure 18 - Flat Roof Termination

Gas Supply and Gas Pipe Sizing

Gas Piping

⚠ WARNING! This water heater is designed for Natural Gas operation only. Refer to the water heater's rating plate. Failure to follow these instructions can result in serious injury or death from explosion, fire or carbon monoxide poisoning.

Ensure that any and all gas regulators used are operating properly and providing gas pressures within the specified range as shown in Table 12. Excess gas inlet pressure may cause serious accidents.

Gas piping must be installed according to local and state codes, or in the absence of these codes, the current editions of ANSI Z223.1/NFPA 54, National Fuel Gas Code.

- **DO NOT** attach the gas line to the water heater until after the supply line pressure testing has been completed to avoid any damage to the water heater.
- The minimum and maximum inlet gas pressures are shown in Table 12:

Table 12: Minimum & Maximum Inlet Gas Pressures

Gas Type	Inlet Gas Pressure
Natural Gas	Min. 4.0" W.C. Max. 10.5" W.C.

Size the gas pipe appropriately to supply the necessary volume of gas and allowable pressure drop required for the water heater using the manufacturer's gas piping instructions, local and state codes, or in the absence of these codes, the current editions of ANSI Z223.1/NFPA 54, National Fuel Gas Code. Otherwise, flow capabilities and output temperatures will be limited. See Table 13 on the following page.

NOTICE: If you are replacing a smaller input water heater, you may need to increase the gas line size.

- Inlet gas pressures that fall outside the range of values listed above may adversely affect the performance of the water heater. These pressures are measured when the water heater and any other gas appliance served by the same gas line are in full operation.
- Inlet gas pressure must not exceed the maximum values in Table 12; gas pressure above the specified range will cause dangerous operating conditions and damage the unit.
- If the gas supply pressure to the heater is greater than the specified maximum, a field-supplied regulator is required. The regulator must lower the gas pressure within the approved range.
- Install the gas regulator according to the manufacturer's instructions. Some manufacturers may require a certain amount of straight pipe on the outlet prior to any additional fittings.
- The regulator must be sized for the water heater's minimum to maximum input and provide the specified pressures that are listed on the rating plate.
- In the absence of minimum install distance stated by the regulator manufacturer, it is recommended that there be at least 3 ft. of piping between the regulator outlet and the water heater's inlet gas connection.

Gas Connections

1. Use a 3/4 inch union to connect gas piping to the water heater's 3/4 inch male NPT connection.

NOTICE: Refer to Table 13 if 1/2 inch piping is desired. If the maximum input of the unit is greater than the maximum delivery capacity for the installation's length of 1/2 inch pipe, then 3/4 inch piping is required.

2. Install a full port manual gas shut-off valve between the water heater and the gas supply line.

3. When the gas connections are completed, it is necessary to perform a gas leak test either by applying soapy water to all gas fittings and observing for bubbles or by using a gas leak detection device.

- The water heater and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi (3.5 kPa).
- The water heater must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi (3.5 kPa).

4. Always purge the gas line of any debris and/or water before connecting to the gas inlet.

Natural Gas Supply Piping

Maximum delivery capacity of cubic feet of gas per hour of IPS pipe carrying Natural Gas with 0.60 specific gravity based on 0.5" W.C. pressure drop.

Based on Energy Content of 1,000 BTU/Cubic feet, the water heater requires:

- 180 ft³/hr for the TI/TO-180 model
- 199 ft³/hr for the TI/TO-199 model

Table 13 below is from ANSI Z223.1/ NFPA 54.

Gas Sizing Example

Based on Energy Content of 1,000 BTU/Cubic feet (Figure 19):

1. Divide each appliance's BTU/h requirement by 1,000 BTU/ft³ to get the appliance's ft³/h requirement. Take into account the distance the appliance is from the gas meter. Use Table 13 and Figure 19 below to properly size the line.

2. For sections of the gas line supplying gas to more than one appliance (e.g., Point A to Point B), add up the cubic feet per hour requirements of the appliances that are being supplied by that section, and size to the farthest appliance.

FOR EXAMPLE: The section from A to B supplies gas to the furnace, range and dryer. Adding up the BTU/h requirement and dividing by 1,000 yields a cubic ft per hour requirement of 220 ft³/hr of gas. The farthest appliance is the range, which is 50 ft away from the meter. Looking at the chart below, and under the column of 50 ft, Section A to B needs to be 1" in order to supply 220 ft³.

Table 13: Natural Gas Supply Piping — Unit: Cubic feet per hour

Pipe Size	Length: ft (m)												
Diameter: in.	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	125'	150'	200'
1/2"	172	118	95	81	72	65	60	56	52	50	44	40	34
3/4"	360	247	199	170	151	137	126	117	110	104	92	83	71
1"	678	466	374	320	284	257	237	220	207	195	173	157	134
1-1/4"	1,309	957	768	657	583	528	486	452	424	400	355	322	275
1-1/2"	2,090	1,430	1,150	985	873	791	728	677	635	600	532	482	412
2"	4,020	2,760	2,220	1,900	1,680	1,520	1,400	1,300	1,220	1,160	1,020	928	794

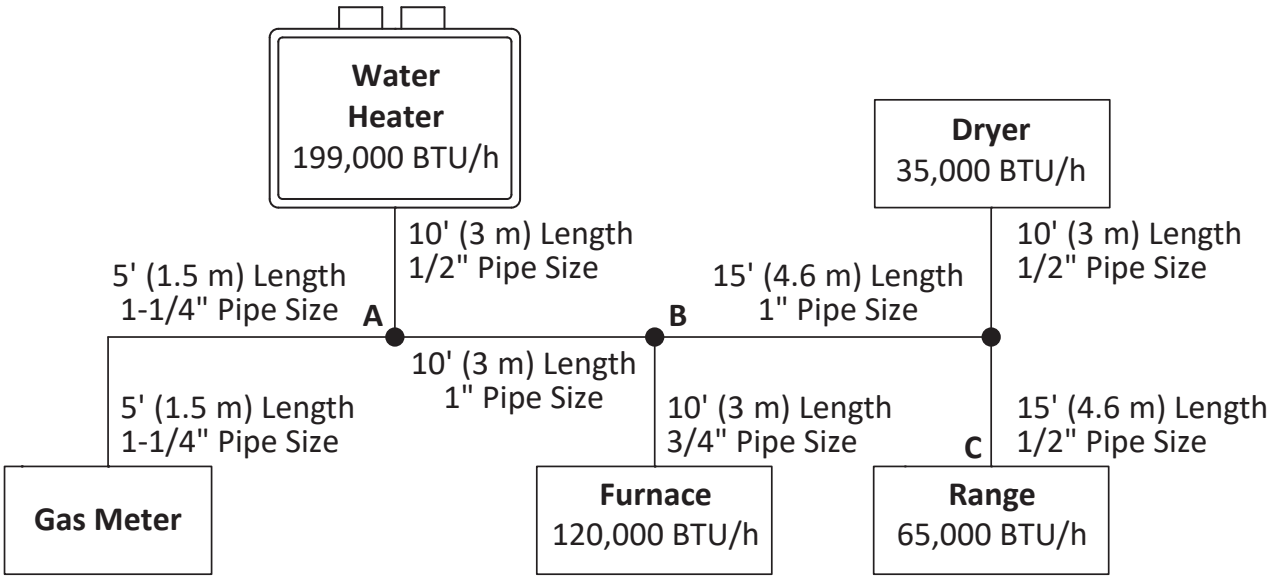


Figure 19 - Pipe Sizing Diagram

Water Connections

⚠ WARNING! DO NOT use this appliance if any part has been under water. Immediately contact a qualified installer or service agency to replace a flooded water heater. DO NOT attempt to repair the unit! It must be replaced!

IMPORTANT: DO NOT reverse the hot outlet and the cold inlet connections to the water heater. If you reverse the connections, the water heater will not activate properly.

Determine the type of water pipes in your home. Use fittings appropriate for the type of pipe in your home (copper, CPVC or PEX). Do not use iron or PVC pipe – they are not suitable for potable water. All pipes, pipe fittings, valves and other components, including soldering materials, must be suitable for potable water systems. Also, an automatic air vent or air separator must be installed when the water heater operates in a closed loop system such as a recirculation system. Trapped air bubbles in the water system can cause a pump to cavitate or damage the water heater's heat exchanger. This equipment must be installed according to the manufacturer's instructions.

A manual shut-off valve must be installed on the cold water inlet to the water heater between the main water supply line and the water heater. In addition, a manual shut-off valve is also recommended on the hot water outlet.

If the water heater is installed within, or subjected to, a closed loop water system, a thermal expansion tank or code approved device to handle thermal expansion must be installed. Follow the expansion device manufacturer's instructions for proper installation and operation.

NOTICE: If the plumbing system is subject to water hammer, then it is recommended that water hammer arrestors be installed.

Making Water Connections

IMPORTANT: Before installing the water heater, flush the water line to remove all debris, and after installation is complete, purge the air from the line. Failure to do so may cause damage to the heater.

NOTICE: There is a wire mesh filter within the cold inlet to trap debris from entering your water heater. This will need to be cleaned periodically to maintain optimum flow.

The water inlet and outlet threaded connections are brass. When connecting the unit to piping made of a different material, use of a dielectric fitting or a dielectric union conforming to ASSE 1079 is recommended to prevent corrosion and potential subsequent water leaks at or near the connection. Dielectric fittings may be required by local plumbing codes.

1. Connect the hot water supply using 3/4 inch NPT to the fitting marked "HOT." Follow the same connection guidelines as for the cold water supply marked "COLD."

2. Double check to make sure the hot and cold water pipes are connected to the correct hot and cold water fitting on the water heater.

3. Install insulation (or heat tape) on the water pipes especially if the indoor installation area is subject to freezing temperatures. Insulating the hot water and return pipes will reduce heat loss.

4. If water hammer is evident, install water hammer arrestors on the inlet side of the water heater.

5. If needed, install (or adjust) the home's Pressure Reducing Valve.

6. A drain pan, or other means of protection against water damage, is recommended to be installed under the water heater in case of leaks.

IF YOU HAVE COPPER PIPES

If your home has copper water pipes, you can solder the water pipe connections or use compression fittings which do not require soldering. Compression fittings are easier to install than soldering pipe. Check with local plumbing officials to determine what types of pipe materials are suitable for your location. **DO NOT** use lead-based solder.

NOTICE: DO NOT solder pipes while they are attached to the water heater. The water heater contains non-metallic parts which could be damaged. The proper way to connect the water heater to copper water pipes is as follows:

1. Solder a short length of pipe (about a foot or so) to a threaded adapter using only 95/5 tin antimony or equivalent solder.

2. Attach the threaded adapters to the water heater's connections (using thread sealant tape or pipe joint compound).

3. Connect the home's water pipes by soldering, keeping the connections at the water heater cool with wet rags.

X3® Technology

⚠ WARNING! DO NOT operate water heater until the X3® Cartridge has been installed into the manifold located on the underside of the water heater cabinet. Failure to do so may result in leaks and potential property damage.

NOTICE: Base (B Model) configuration does not have X3®cartridge capability.

This water heater may be equipped with X3® Scale Prevention Technology to inhibit scale formation within the heat exchanger tubing of this unit. Part of the X3® Technology's anti-scale protection comes from the special X3® Cartridge media. The X3® Cartridge must be installed into the manifold located on the underside of the heater cabinet prior to operation of the unit (shown as follows). X3® Scale Prevention Technology reduces the formation of scale in the heat exchanger, extending the operating life of the unit in typical potable water installations. Specific water conditions may impact the efficiency of X3®, such as excessive iron (max limit 0.3 mg/l or 0.3 ppm) or manganese (max limit 0.05 mg/l or 0.05 ppm) levels.

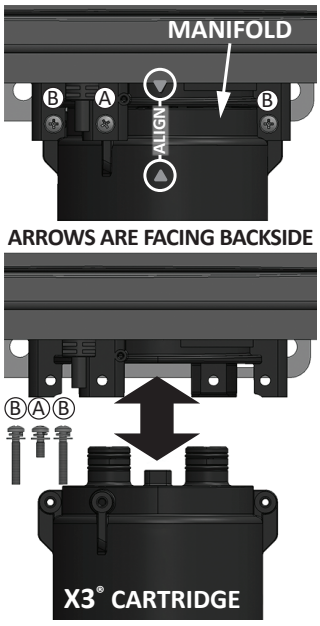


Figure 20 - X3® Cartridge Installation

X3® Cartridge Installation

1 Remove the plug assembly installed into the manifold located on the underside of the water heater cabinet. Properly dispose of plug assembly materials.

⚠ CAUTION! Water may be present in the manifold. Place a bucket under the water heater cabinet to collect any residual water.

2 Locate the three (3) screws provided in the hardware bag on the top of the water heater carton. Set the one Ⓐ screw (M4-12mm) and two Ⓑ screws (M4-25mm) aside in a safe place (Figure 20).

3 Locate the X3® Cartridge provided with the water heater.

NOTICE: Inspect O-rings for damage or debris. Handle with care and verify lubricant has been properly applied to O-rings.

4 Insert the X3® Cartridge into manifold and secure with the one Ⓐ screw and two Ⓑ screws previously set aside in **Step 2**.

NOTICE: The X3® cartridge is keyed to only install in one direction. Align the ▲ on the X3® cartridge with the ▼ on the manifold (arrows will be back facing for TI & TO series heaters). When inserting the X3® cartridge, push up until the screw holes align. Some resistance is normal. See Figure 20 for reference.

Insert and snug all three screws by hand. Use a screwdriver to tighten the two Ⓑ screws first and lastly tighten the one Ⓐ screw. **DO NOT** use a drill or impact driver to tighten the screws.

X3® Cartridge Removal

1 Disconnect power to the water heater by unplugging it or by turning off the circuit at the breaker box.

2 Close the cold inlet water valve.

3 Open all hot water taps in the house. When the residual water flow has ceased, close all hot water taps.

NOTICE: Place a bucket under the water heater cabinet to collect any residual water.

4 Remove the two Ⓑ screws and the one Ⓐ screw securing the X3® Cartridge to the manifold located on the underside of the water heater cabinet. Set the screws aside in a safe place for re-installation. Note the order of the screws when removing them. Reference Figure 20.

5 Pull down to remove the X3® Cartridge from the water heater.

NOTICE: The X3® Cartridge will be full of water. Use caution not to tilt the cartridge until the water has been drained.

Outdoor Model Cartridge Accessories

It is recommended that a Cartridge Freeze Protection Kit be installed if the water heater is installed outside or in unconditioned areas subject to freezing temperatures.

A pipe cover is available and affixes to the bottom of the water heater. It protects plumbing connections to the water heater while improving the appearance of the installation.

For more information see "Available Accessories" on page 21.

Pressure Relief Valve

⚠ WARNING! Hot water could be released. Before operating the pressure relief valve manually, check that it will discharge in a safe place. If water does not flow freely from the end of the discharge pipe, turn the gas supply and power OFF and call a qualified person to determine the cause.

Refer to the pressure relief valve manufacturer's instructions for inspection and maintenance requirements.

The water heater has a high-temperature shut-off switch built in as a standard safety feature (called a Hi-Limit switch), therefore a "pressure only" relief valve is required.

An approved pressure relief valve is supplied with X3® configurations. An approved pressure relief valve shall be field supplied for B configurations.

The discharge piping for the pressure relief valve must be directed so that hot water cannot splash outward and cause damage or personal injury.

Attach the discharge tube to the pressure relief valve and run the end of the tube to a maximum of 6 inches from the floor (Figure 21). This discharge tube must allow free and complete drainage without any restrictions.

If the pressure relief valve discharges periodically, this may be due to thermal expansion in a closed water supply system. Contact the water supplier or a local plumbing professional on how to correct this situation.

⚠ WARNING! DO NOT plug the pressure relief valve.

The pressure relief valve must be manually operated periodically to check for correct operation. Before operating the valve manually, check that it will discharge in a place for secure disposal.

NOTICE: No valve must be placed between the pressure relief valve and the water heater.

If another pressure relief valve is used or needs to be replaced, it must meet the following:

1. The pressure relief valve must conform to ANSI Z21.22 • CSA 4.4, and installation must follow local codes.

2. The discharge capacity must be at least:

- 180,000 BTU/h for TI/TO-180 model
- 199,000 BTU/h for TI/TO-199 model

3. The pressure relief valve needs to be rated for a maximum of 150 psi.

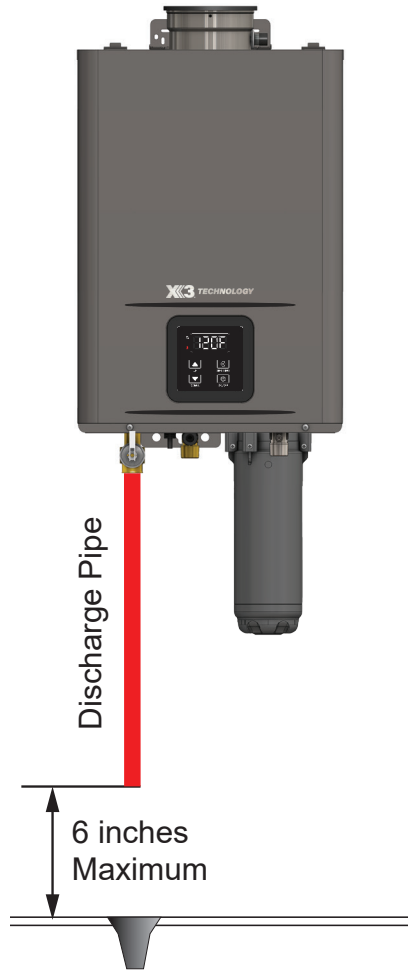


Figure 21 - Discharge Pipe Clearance

Recirculation

When installing a recirculation pump, care must be taken to properly size the pump for the application. Sizing must be performed by the installing contractor or engineer. Below are the requirements that need to be followed when sizing:

NOTICE: Running the pump continuously will reduce the warranty of the water heater.

- Size the recirculation pump to flow no less than 2 gpm and no more than 4 gpm per heater activation. The manufacturer's suggested flow rate is 3 gpm. Refer to the water heater's pressure drop chart on its specification sheet for losses at other flow rates. See Table 14 below for potential head loss.

Table 14: Head Loss

Model	Flow Rate	Head Loss
X3® Models	3 gpm	27.2 ft.
B Models	3 gpm	22.2 ft.

- The pump should be controlled by a field supplied aquastat with immersion probe and an adjustable differential. The minimum suggested differential is 15°F.

  IMPORTANT: If the inlet water thermistor in the water heater measures the temperature of inlet water above the temperature setting, or above 122°F, the water heater will shut down. In this scenario the water heater will display code **E383**.

- An air elimination device is suggested to remove air from the piping system. Air may cause the recirculation pump to cavitate and may reduce the water flow rate. These items should be installed per the manufacturer's instructions.

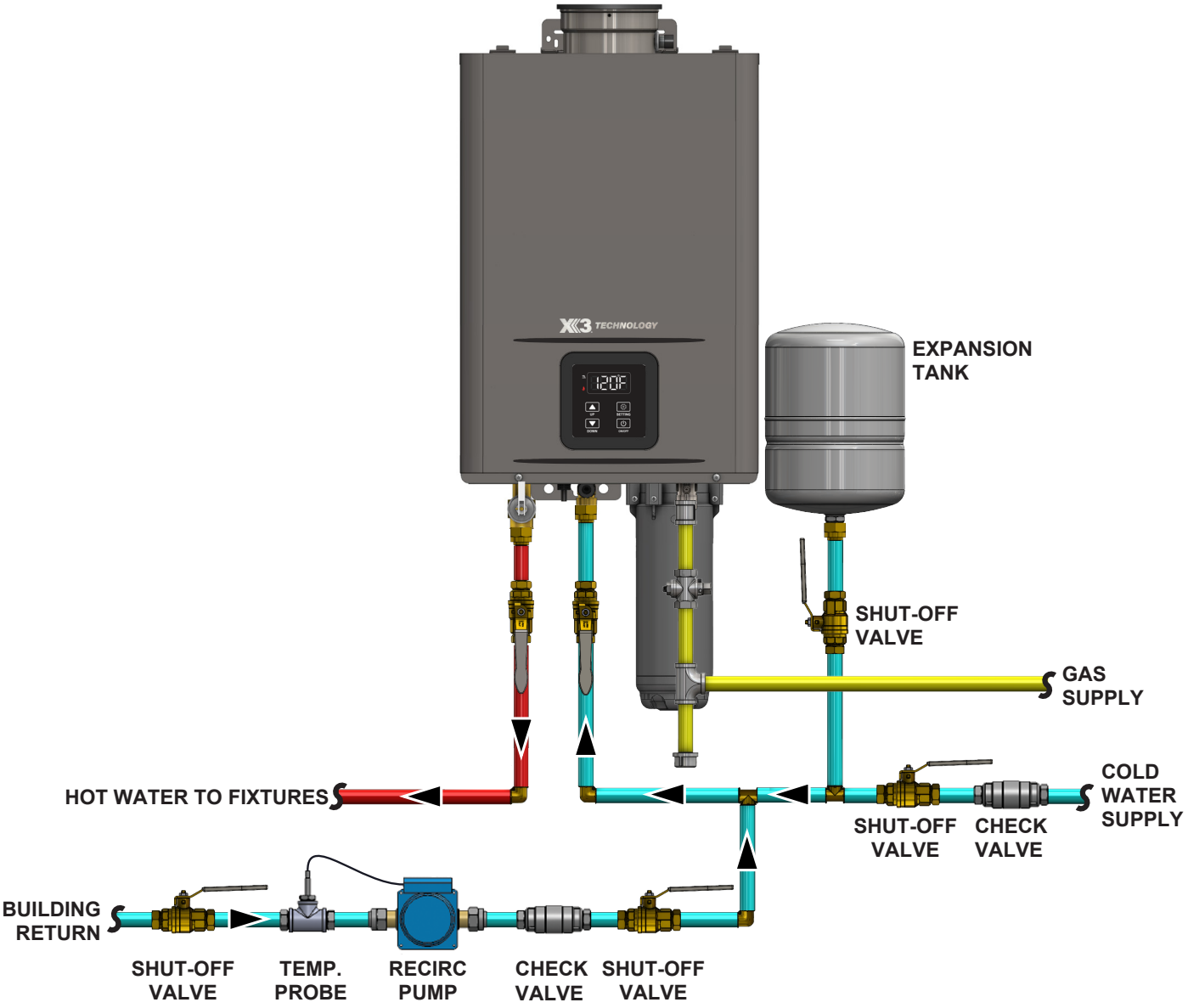
The installer will need to consider the size of water tubing, material type, and fittings when determining the pressure drop of the system to size the recirculation pump.

NOTICE: These characteristics vary for each tubing material of the same nominal size. Refer to the water tubing manufacturer for pressure drop information that is needed to size the recirculation pump. Check with local codes and ordinances for additional installation requirements.

Point-of-use thermostatic mixing valves may be used with tankless water heaters. Consult with the point-of-use thermostatic mixing valve manufacturer for the appropriate valve for the application. Refer to the point-of-use thermostatic mixing valve manufacturer for proper installation when recirculation is in use.

⚠ WARNING! To reduce the risk of unusually hot water reaching the fixtures in the house, install Thermostatic Mixing Valves at each point-of-use.

NOTICE: Figure 22 on the following page provides the manufacturer's suggested piping layout for recirculation. The suggested piping layout is applicable to both indoor and outdoor installations. The installer must properly install the system according to the manufacturer's instructions and local codes. Refer to the water heater manufacturer's website for additional layouts.



NOTICE: The piping layout shown above is applicable to both indoor and outdoor installations.

Figure 22 - Recommended Recirculation Diagram (Indoor and Outdoor Installations)

Electrical Connections

⚠ WARNING! Working on an energized circuit can result in severe injury or death from electrical shock.

⚠ WARNING! The water heater must be electrically grounded. DO NOT attach the ground wire to either the gas or the water piping.

Power Supply

- The water heater requires a 120 VAC, 60 Hz electrical power supply that is properly grounded.
- A proper disconnect (i.e., ON/OFF switch, power plug, etc.) controlling the main power to the water heater must be provided for service reasons. This disconnect must comply with local codes.
- The water heater can be hardwired or plugged into an outlet with the correct voltage (listed above) using the supplied power cable already attached.
- The use of a surge protector is recommended in order to protect the unit from power surges.

Plug-in Connection

1. The water heater should be plugged into a 120 VAC, 60 Hz ground electrical outlet.

Hardwired Connection

NOTICE: Follow the steps below if the power supply must be hardwired to the water heater. Otherwise, you may skip this section.

1. Remove and keep the two screws securing the front cover. Remove the cover.
2. Locate the system power cord and cut the wires at the location shown in Figure 23.

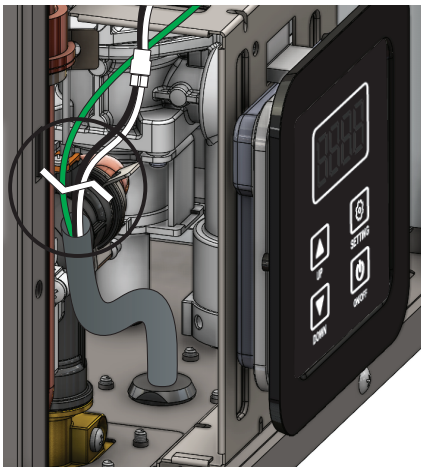


Figure 23 - System power cord cut location.

3. Remove the screws securing the power cord to the bottom of the water heater.
4. Remove the power cord from the bottom of the water heater and install a strain relief connector in the opening.
5. Make the electrical connection to the water heater. Follow the electrical code requirements of the local authority having jurisdiction. In the absence of local codes, follow the current edition of the National Electrical Code ANSI/NFPA 70.
6. Verify all electrical connections are secure.
7. Replace the front cover and secure with the two screws previously removed. Turn on power to the water heater.
8. Follow the instructions in the Getting Started section of this manual.

Outdoor Model Connection

The outdoor model water heater comes equipped with a SJWT rated cord which is weather resistant and rated for outdoor use.

The outdoor model water heater includes a remote controller to configure and operate the system. The manufacturer recommends the remote controller should be installed indoors for convenience and to protect the controller from hazardous weather conditions and freezing temperatures.

See the "Accessory Connections" section and Figure 28 for more information on proper installation for outdoor model water heaters.

Accessory Connections

This system supports up to three accessories connected in series.

⚠ CAUTION! Water heater accessories are not approved for outdoor installation. Components used in accessory installation must be installed in an indoor environment and protected from hazardous weather conditions and freezing temperatures.

NOTICE: If multiple water heaters are used in a Cascade System, then all accessories must be connected in series to the parent unit.

Follow the accessory kit instructions to access the control board.

Each accessory has both a five-pin female connector and a section of cable with a five-pin male connector on the end. The male connector connects to the Printed Control Board (PCB) or to the next accessory in the series. The five-pin female connector allows another accessory to connect and create a series. When creating a series of accessories, reference Figure 27 for indoor model water heaters and Figure 28 for out outdoor model water heaters.

If the length of the accessory cord is not long enough, communication cables can be purchased to extend the length. These cables are available in 10 ft. and 32 ft. lengths. Connect the single five-pin connector on the communication cable to the five-pin female connector on the accessory. The maximum wire length from the water heater (the Parent unit in a Cascade System) to the farthest accessory is 100 feet.

IMPORTANT: A remote controller assembly is provided with the outdoor model water heater. Proceed to the following section for instructions on how to mount the remote controller.

Mounting the Remote Controller

Follow the procedure below to mount the remote controller provided with the outdoor model water heater. Once the remote controller has been properly mounted, use Figure 28 to connect the controller to the outdoor model water heater.

1. Locate the remote controller and metal mounting bracket provided with the water heater.

2. Secure the mounting bracket to the wall using the four (4) provided screws and wall anchors. Reference Figure 24 for the orientation of the mounting bracket when mounted.

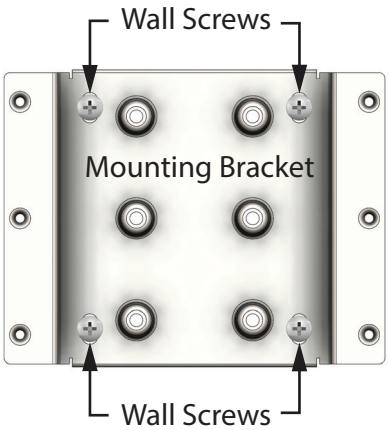
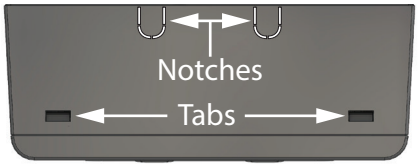


Figure 24 - Securing the mounting bracket to the wall

NOTICE: Ensure the communication cable has sufficient length to reach the desired location for the remote temperature controller. Ensure the cable is routed proper and not exposed to any sharp edges. Also ensure that it is mounted safely as to not cause any trip or safety hazard.

3. Use a small flathead screwdriver to depress the tabs holding the front cover of the remote temperature controller. Set the front cover aside in a safe place for reinstallation. See Figure 25.

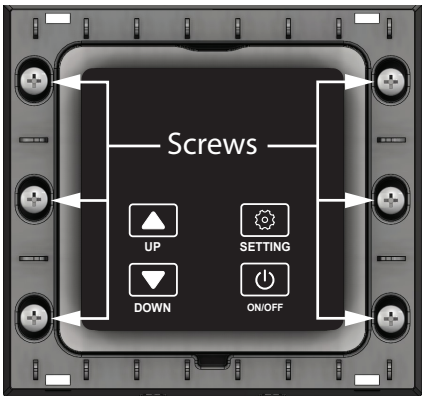


Remote Controller, Front Cover Installed (Bottom View)

Figure 25 - Front cover removal

4. The remote temperature controller has two (2) cable routing notches on the top and two (2) on the bottom. Remove the plastic tab from the desired notch and route the communication cable through it. See Figure 25.

5. Locate the six (6) screws provided in the kit. Secure the remote temperature controller to the mounting bracket using the provided screws. Make sure the communication cable is affixed in the notch before securing the remote temperature controller to the mounting plate. See Figure 26.



Remote Controller, Front Cover Removed (Front View)

Figure 26 - Mounting screw location

Accessory Connections (Indoor Model)

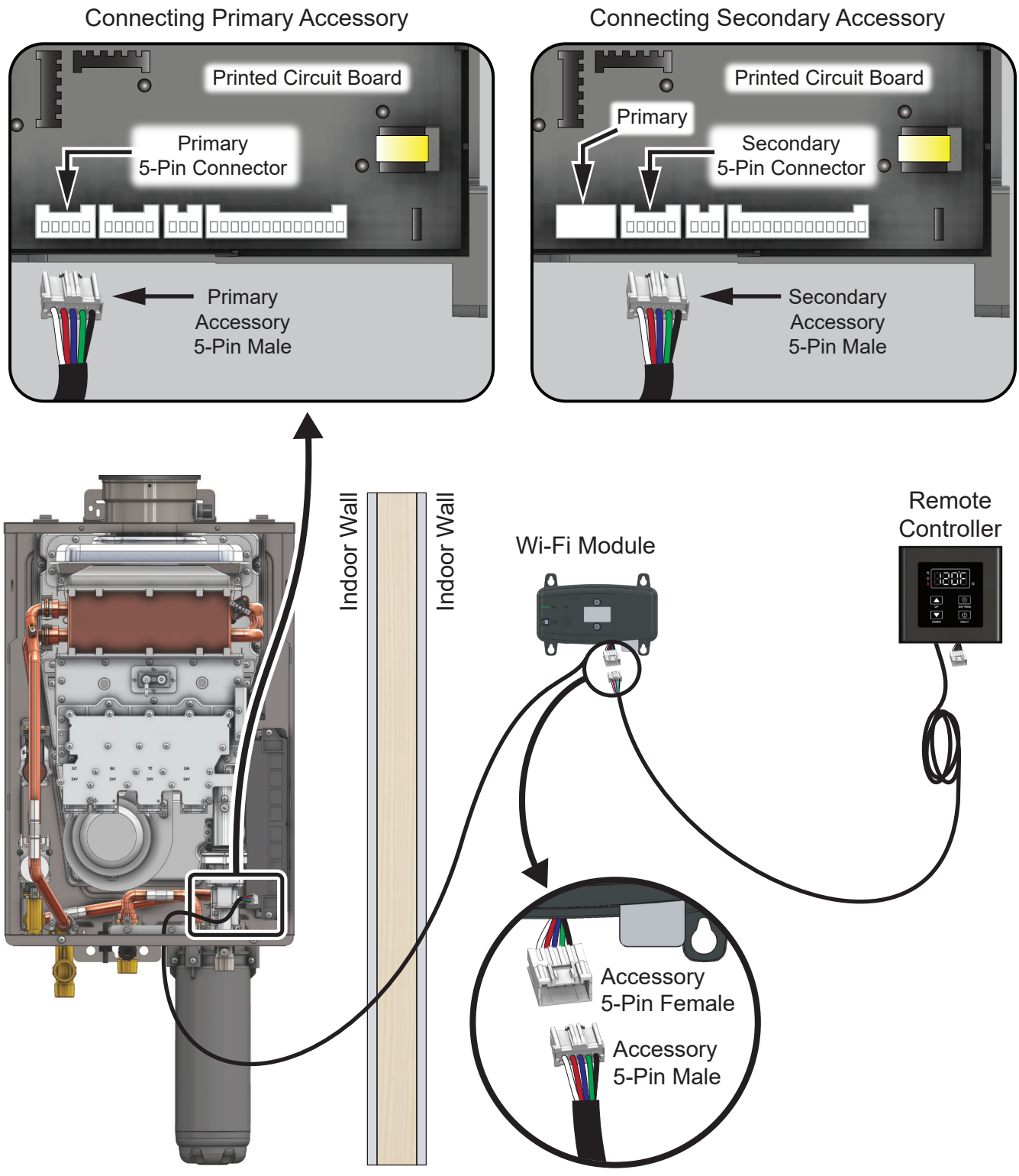


Figure 27 - Accessories Installed in Series (Indoor Model)

Accessory Connections (Outdoor Model)

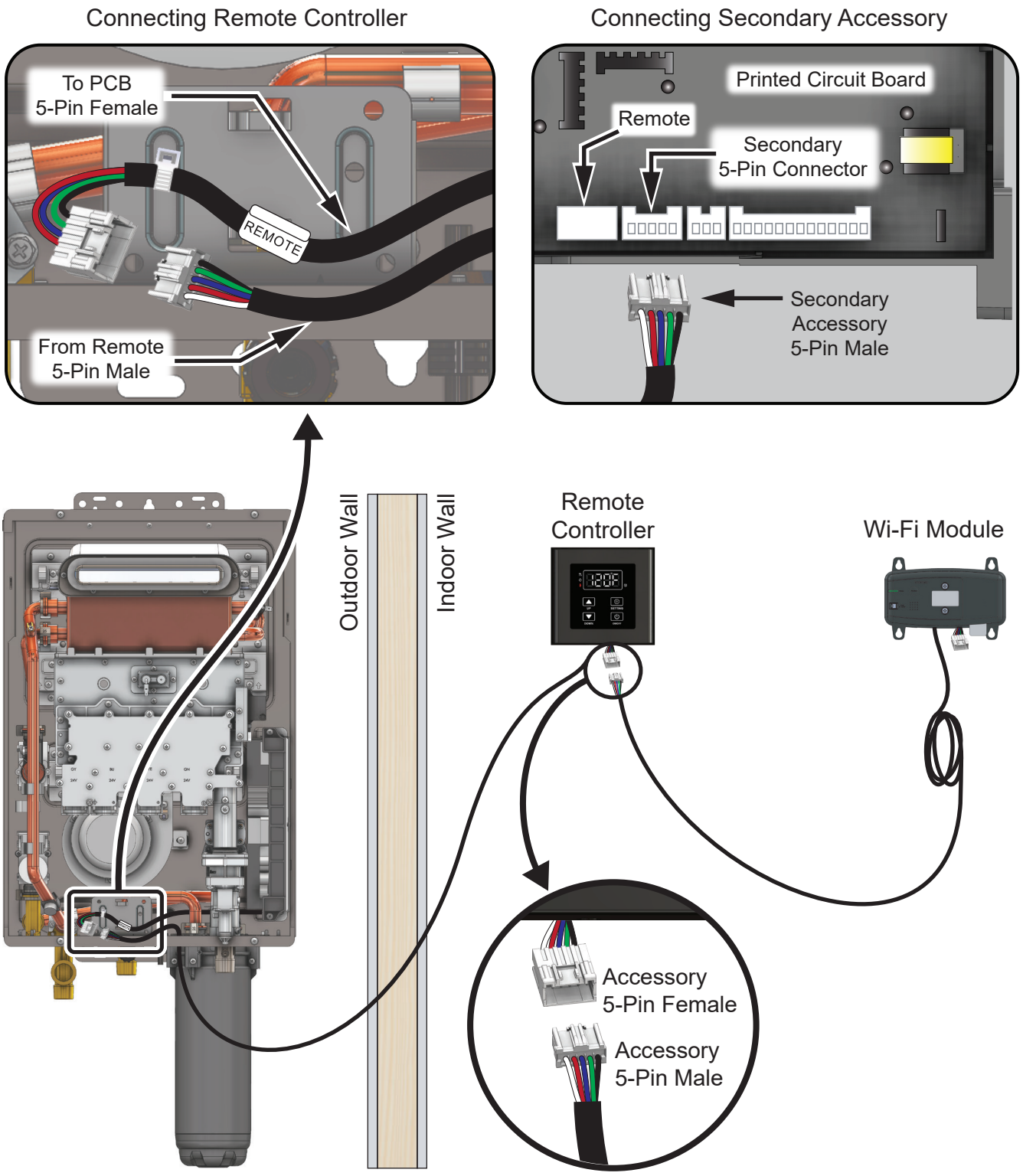


Figure 28 - Accessories Installed in Series (Outdoor Model)

Cascade System

The Cascade System allows up to 12 heaters of the same input rate and model to be linked in a Parent/Child configuration. **DO NOT** link heaters with different input rates or dissimilar models together. **DO NOT** link heaters for indoor and outdoor applications together.

IMPORTANT: Failure to cascade heaters of the same input rate and model series will result in a system error code.

The Cascade System will activate heaters based on the system flow rate demand. When system demand increases or decreases, the cascade system will activate/deactivate heaters as needed to balance flow through the heaters.

The Parent heater determines when to activate/deactivate heaters. The order of heater activation is set by the Parent heater and will sequence the heaters in order from the least combustion hours to the most. This allows for even operation of all the water heaters in the cascade system. The heaters will deactivate in the reverse order that they are activated, meaning if Child Heater 11 was the last to turn on, it will be the first to turn off when system demand decreases. The Parent heater will reorder the sequence on a weekly basis.

The new sequence of activation will start with the heater that has the least combustion hours to the most. Each heater will activate based on predetermined flow rate factors. These factors vary based on heater model.

If any child heater encounters an error code, the cascade system will bypass that heater and continue to operate. If the Parent heater loses power, then the cascade system deactivates. The user will need to change the settings of one of the other heaters to be the Parent or resolve the issue of the Parent heater.

⚠ WARNING! Working on an energized circuit can result in severe injury or death from electrical shock.

IMPORTANT: Each water heater must be properly configured for Altitude (C01), Vent Type (C08) and Vent Length (C02) before linking the units in the Cascade system. See the "Configuration Mode (C Mode)" section on page 50 for information on how to properly configure the water heaters.

1. The Cascade system should be configured with the Parent water heater as either the first or last in the series of water heaters connected to the cold water supply. The Child units will follow sequentially. See Figure 31.
2. Before proceeding, disconnect electrical power to all water heaters in the Cascade configuration.
3. Remove the front covers and keep the two screws from both the Parent and Child water heaters for re-installation.
4. Remove the two screws (top and bottom) securing the control panel to the Parent water heater. The control panel is located on the bottom right side of the water heater as shown in Figure 29.
5. Gently slide control panel out from the Parent water heater to gain access to the Printed Circuit Board (PCB). Proceed with caution and **DO NOT** disconnect wires from PCB.
6. Use Figure 30 to locate the rubber access grommet on the bottom of the water heater. Route the single harness end of the Cascade Linking Cable through the bottom and around to the circuit board.

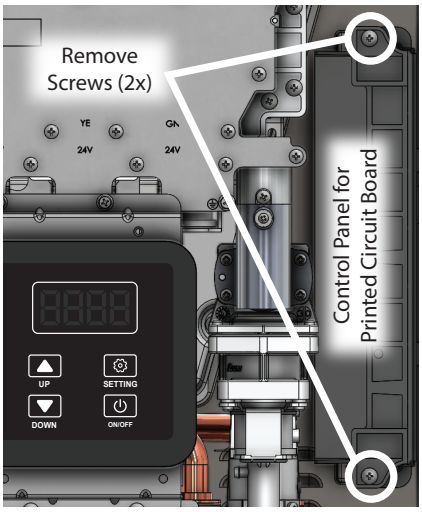


Figure 29 - Control Panel Location

NOTICE: The cable should be routed under the circuit board assembly to prevent strain on the wiring harness.

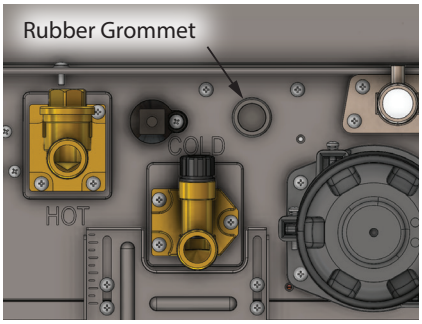


Figure 30 - Bottom of water heater - Grommet

7. Use Figure 31 as a reference to locate the connection point for the Parent Cascade Unit. Use the single harness end of the Cascade Linking Cable to make the initial connection.
8. Follow steps 4-6 to route the double harness end of the Cascade Linking Cable to the printed circuit board on the first Child water heater.
9. If more than one Child water heater is used, then route the single harness end of the second Cascade Linking Cable through the rubber grommet on the bottom of the first Child water heater and connect it to the open harness on the

first Cascade Linking Cable as shown in Figure 31.

10 Once all connections are made, the water heaters must be assigned their position in the system. Turn on the power supply to all of the water heaters, making sure there is no water flow.

11 On the Parent water heater simultaneously press and hold the "**SETTING**" and "**UP**" buttons until C00 appears. See the "Configuration Mode (C Mode)" section and Table 21 on page 51.

12 Press the UP arrow button to reach the C13 option, then press the "**SETTING**" button to enter that option.

NOTICE: C13 defines the number of Child water heaters that will be connected to the parent unit.

Enter the number of Child water heaters attached to the parent water heater and press the "**SETTING**" button to load the number to memory. For example, if the system consists of four total water heaters, then enter 3 for three child heaters into C13. Press the "**SETTING**" button again to return to normal operation.

13 After the Parent water heater is configured, the Child water heaters must be configured. Perform the following steps on each Child water heater.

14 On each Child unit's display, press and hold both the "**SETTING**" and "**UP**" buttons until C00 appears.

15 Press the UP arrow button to reach the C14 option, then press the "**SETTING**" button to enter that option.

NOTICE: C14 defines the number assigned to each Child water heater connected to the parent water heater.

16 Enter number 2 for the first Child water heater and press the "**SETTING**" button to load the number to memory. Repeat this step assigning a sequential number to each additional Child water heater.

17 Press and hold the "**SETTING**" and **"UP"** buttons again to return to normal operation.

NOTICE: A maximum 11 Child water heaters can be connected to a Cascade System of 12 total water heaters.

18 Verify all electrical connections and conduit connections are secure.

19 Follow the instructions in the Getting Started section of this manual.

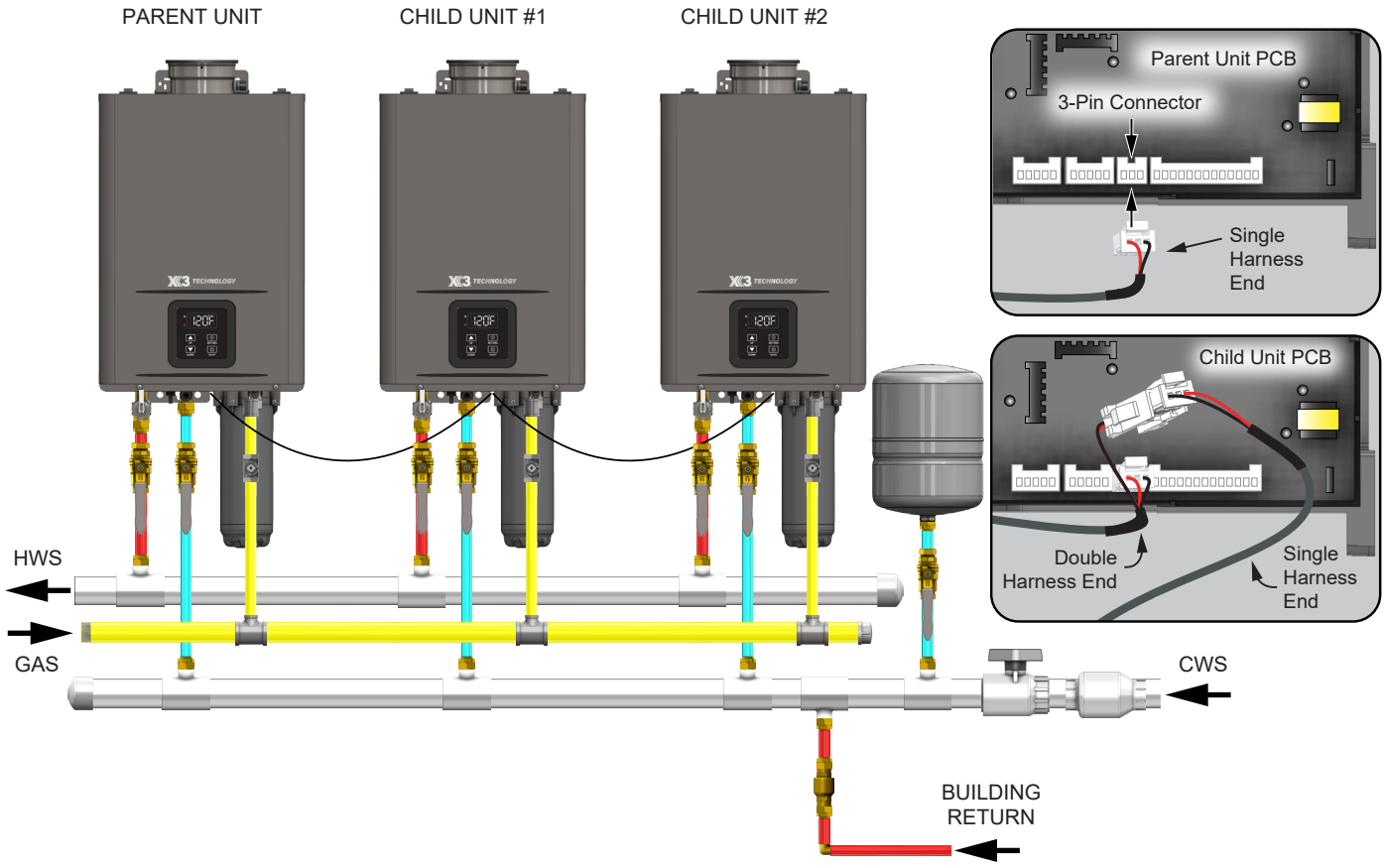


Figure 31 - Multi Unit Cascade Configuration

OPERATION

FOR YOUR SAFETY, READ BEFORE OPERATING

⚠ WARNING! IF YOU SMELL GAS:

- **DO NOT** try to start the water heater.
- **DO NOT** touch any electric switches.
- **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.
- Failure to observe these warnings could lead to fire or an explosion, resulting in severe injury or death.

✓ Check the **GAS** and **WATER CONNECTIONS** for leaks before firing unit for the first time.

✓ Open the main gas supply valve to the unit using only your hand to avoid any spark. Never use tools. If the knob will not turn by hand, **DO NOT** try to force it; call a qualified service technician. Forced repair may result in a fire or explosion due to gas leaks.

✓ Be sure to check for the presence of leaking gas toward the bottom of the unit because some gases are heavier than air and may settle towards the floor.

✓ Check the **GAS PRESSURE**. Refer to the "Gas Supply and Gas Pipe Sizing" section on page 33.

✓ Check for **PROPER VENTING** and **COMBUSTIBLE AIR** to the water heater.

✓ Purge the **GAS** and **WATER LINES** to remove any air pockets.

✓ **DO NOT** use this appliance if any part has been under water. Immediately contact a qualified installer or service agency to replace a flooded water heater. **DO NOT** attempt to repair the unit! It must be replaced!

Start-Up Instructions

Read and understand these directions thoroughly before attempting to start-up the water heater. Make sure the water is plumbed correctly before attempting to start-up the water heater. Check the rating plate near the gas control valve to ensure the correct gas type. **DO NOT** use this water heater with any gas other than the one listed on the data plate. If you have any questions or doubts, consult your gas supplier or gas utility company.

NOTICE: A newly installed water heater will have air in the gas line. It may take several attempts to clear all the air from the gas line.

1. Make sure the manual gas valve for the water heater's supply line is **ON**.
2. Plug the water heater into a grounded 120 VAC outlet, or activate the breaker/disconnect, if the water heater is hardwired.
3. The user interface module (UIM) or remote controller will display the current temperature setting. The default is 120°F.
4. To change the set point temperature, press the "**UP**" or "**DOWN**" button to raise or lower the outlet temperature. See the "Temperature Settings" section on page 49.
5. To set the heater to the appropriate elevation, vent type and vent length, see "Configuration Mode (C Mode)" starting on page 50.

Shut-Down Instructions

Press the "**ON/OFF**" button and wait for the display to shut off.

NOTICE: The power button on the water heater and remote controller **DOES NOT** disconnect power to the water heater. You must physically disconnect power to the water heater.

Emergency Shut-Down

Should overheating occur or the gas supply fail to shut off, follow these steps:

1. Turn **OFF** the gas supply to the water heater at the manual shut-off valve.
2. Press the "**ON/OFF**" button on the water heater.
3. Disconnect power to the water heater by unplugging it or by turning off the circuit at the breaker box, as appropriate.
4. Call a qualified person (licensed plumber, authorized gas company personnel, or authorized service technician) for assistance.

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

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

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor. WHAT TO DO IF YOU SMELL GAS:

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

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

D. Do not use this appliance if any part has been under water. Immediately contact a qualified installer or service agency to replace a flooded water heater. Do not attempt to repair the unit! It must be replaced!

OPERATING INSTRUCTIONS

1. **STOP! Read the safety information above on this label.**
2. **Turn off all electric power to the appliance.**
3. **Do not attempt to light the burner by hand.**
4. **Turn the gas shutoff valve located on the outside of the unit to the closed position.**
5. **Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.**
6. **Turn the gas shutoff valve located on the outside of the unit to the open position.**
7. **Turn on all electrical power to the appliance.**
8. **If the appliance will not operate, follow the instructions in "To Turn Off Gas to Appliance," and call your service technician or gas supplier.**

TO TURN OFF GAS TO APPLIANCE

1. **Turn off all electrical power to the appliance if service is to be performed.**
2. **Turn the gas shutoff valve located on the outside of the unit to the closed position.**

⚠ DANGER

⚠ **Vapors from flammable liquids will explode and catch fire causing death or severe burns.**

Do not use or store flammable products such as gasoline, solvents or adhesives in the same room or area near the water heater.



Keep flammable products:
1. Far away from heater
2. In approved containers
3. Tightly closed; and
4. Out of the reach of children.

Vapors:
1. Cannot be seen.
2. Are heavier than air.
3. Go a long way on the floor.
4. Can be carried from other rooms to the main burner by air currents.

Water heater has a main burner, which may come on at any time and will ignite flammable vapors.

Installation: Do not install water heater where flammable products will be stored or used unless the main burner is at least 18 inches above the floor. This will reduce, but not eliminate the risk of vapors being ignited by the main burner.

Read and follow water heater warnings and instructions. If the owner's manual is missing, contact the retailer or manufacturer.

⚠ DANGER



1. Water temperature over 125°F (52°C) can cause severe burns instantly or death from scalds.
2. Children, disabled and elderly are at highest risk of being scalded.
3. Feel water before bathing or showering.
4. Temperature limiting valves are available. See manual.
5. To reduce the risk of scalding, install Thermostatic Mixing Valves (temperature limiting valves) at each point of use.
6. The outlet temperature of the water heater is set at 120°F (50°C). If you require water temperatures below this setting, follow the instruction manual.
7. Use this heater at your own risk. Test the water before bathing or showering. Do not leave children or an infirm person unsupervised. See your local water supply company [plumbing hardware retailer] for temperature limiting valves that are available.

A pressure relief valve listed as complying with the standard for Relief Valve and Automatic Gas Shutoff Devices for Hot Water Supply System, ANSI Z21.22 • CSA 4.4, shall be installed at the time of installation of the water heater in the location specified by the manufacturer. Local codes shall govern the installation of relief devices for safety operation of the water heater. The relief valve must not be removed or plugged.

No valve shall be placed between the relief valve and the water heater. The relief from the discharge of the pressure relief valve shall be disposed of in a suitable place where it will cause no damage. Also, there shall be no other reducing coupling or other restrictions installed on the discharge line to restrict flow.

Before operating the pressure relief valve manually, check that hot water coming out of the relief valve will discharge in a safe place to avoid contact with hot water and water damage.

See Installation Manual heading "PRESSURE RELIEF VALVES" for installation and maintenance of relief valve discharge line and other safety precautions.

If installed in South Coast AQMD: For Installation and Use in Existing Buildings Only.

California Prop 65:

⚠**WARNING:** Cancer and Reproductive Harm - www.p65warnings.ca.gov

Figure 32 - Lighting Instructions

OPERATION

User Interface Module (UIM) & Remote Controller Display Overview

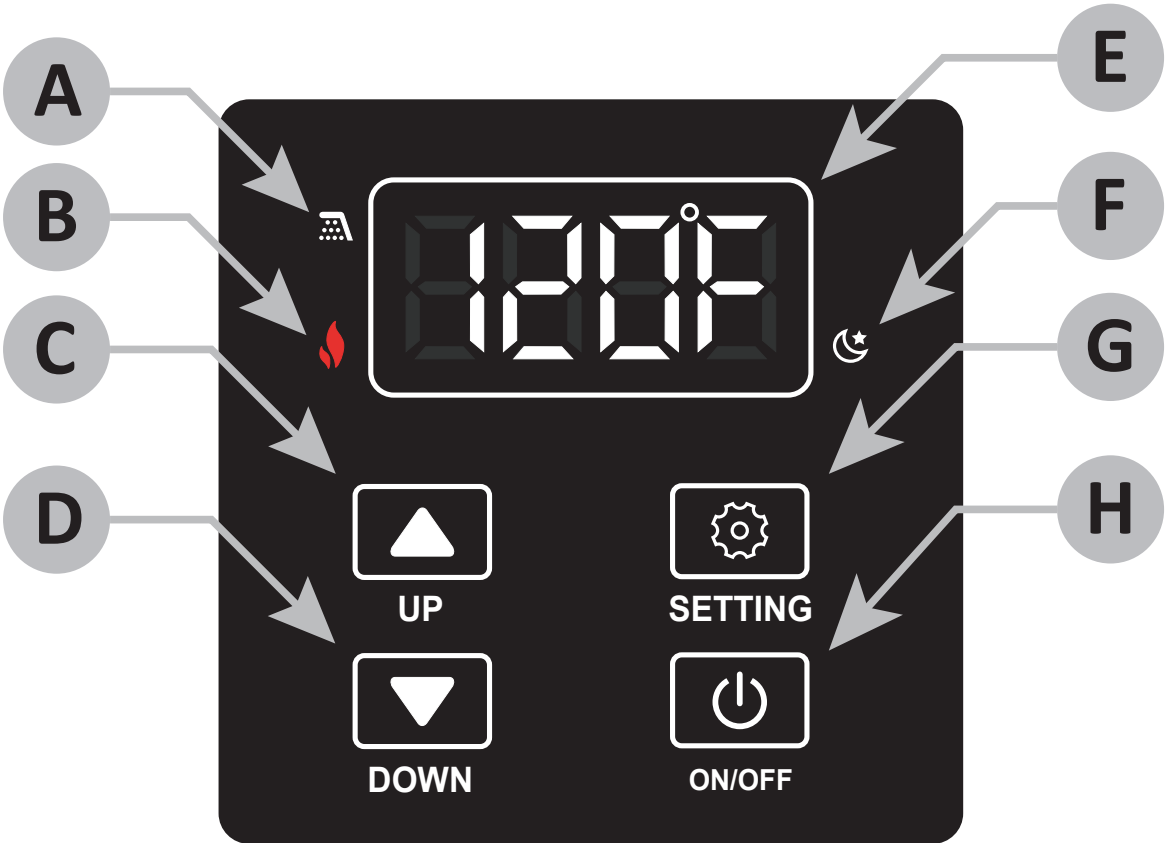


Figure 33 - UIM & Remote Controller Display Diagram

Table 15: UIM & Remote Controller Display

Item	Description
A	Water Flow Detected
B	Flame Detected
C	Up Button
D	Down Button
E	Display
F	Standby Mode
G	Setting Button
H	Operation ON/OFF Button

Temperature Settings

With the installation steps completed, you may adjust the water heater's temperature setting if desired. The water temperature set point is factory set to 120°F. The temperature set point may be increased or decreased by simply pressing the "**UP**" button or the "**DOWN**" button. To set the water heater to a temperature above 125°F, follow the procedure as outlined in Table 16:

Table 16: Set Temperature Above 125°F (52°C)

	Operation	Screen on the Controller (Built-in & Remote)
1.	Turn on the 120 VAC power supply to the unit.	
2.	Press the "**ON/OFF**" button on the controller in order to turn the controller on.	
3.	The set point temperature will display as shown in the picture on the right (Example: 120°F).	
4.	⚠ **WARNING! Higher temperatures increase the risk of scalding, but even at 120°F (49°C), hot water can scald (page 10).** Press and hold the "**SETTING**" button for 5 seconds to access the water heater Adjustment Mode (A Mode).	LONG PRESS 
5.	The display will flash between code "**A00**" and the current set temperature. Short press the "**SETTING**" button to access the temperature setting. The temperature only will flash.	SHORT PRESS 
6.	Press the "**UP**" button and the "**DOWN**" button to select the desired set point temperature. See Table 17 below for available set point temperatures.	
7.	Short press the "**SETTING**" button again to execute the change.	SHORT PRESS 
8.	Press and hold the "**SETTING**" button for 5 seconds to return the display to normal operation. The new temperature set point will appear (Example: 130°F).	

Table 17: Water Heater Temperature Set Points

°F	100	102	104	106	108	110	115	120*	125	130	135	140
°C	38	39	40	41	42	43	46	49*	52	54	57	60

*Factory setting (Default): 120°F

OPERATION

Configuration Mode (C Mode)

The water heater must be configured based on the installation application. If the installation meets all of the “Default” criteria listed, then no adjustments are necessary. Follow the procedure below to access C Mode and to properly configure the water heater:

1. Press and hold the "**UP**" button and the "**SETTING**" button for 5 seconds to access C Mode.
2. Press the "**UP**" button or the "**DOWN**" button to search for the desired C Mode.
3. Press the "**SETTING**" button to adjust the value. The current value will flash. Use the "**UP**" and "**DOWN**" buttons to adjust the setting to the value listed in the applicable table below.
4. Press the "**SETTING**" button again to confirm the new value selected is correct.
5. To adjust additional modes, press the "**UP**" button or the "**DOWN**" button to search for the desired C Mode. To exit C Mode, press and hold the "**UP**" button and the "**SETTING**" button for 5 seconds.

IMPORTANT: If any C08 (Vent Type) value is selected and confirmed, the User Interface Module will display the water heater model number preceded by a dash. The water heater **MUST** be disconnected at the power supply and reconnected to save the C08 selection. This action may take place after all configuration adjustments are complete.

Table 18: C Mode Altitude Settings (C01)

Code	Description	Setting	Indoor Model	Outdoor Model	Configuration Options
C01	Altitude Settings	0	Default	Default	0-2000 ft Elevation
		1	Available	Available	2001-5400 ft Elevation
		2	Available	N/A	5401-7800 ft Elevation
Notes for Proper Configuration (Indoor/Outdoor):					
1) C01 (Altitude) MUST be adjusted before C08 (Vent Type) and C02 (Vent Length). 2) The Outdoor Model does not require further adjustment to C08 (Vent Type) or C02 (Vent Length). 3) If your application meets the Default criteria, then no adjustment to C01 (Altitude) is required.					

Table 19: C Mode Vent Type (C08)

Code	Description	Setting	Indoor Model	Configuration Options
C08	Vent Type	2	Default	Metal-Fab Corr/Guard®
		3	Available	CoxCentric®, Centrotherm, Ubbink
Notes for Proper Configuration (Indoor):				
1) C08 (Vent Type) MUST be adjusted before C02 (Vent Length). 2) When C01 (Altitude) is set to 0, C08 (Vent Type) will default to setting 2 and cannot be adjusted. 3) When C01 (Altitude) is set to either 1 or 2, select the appropriate C08 (Vent Type) value based on the listed venting above. 4) If your application meets the Default criteria, then no adjustment to C08 (Vent Type) is required.				

Table 20: C Mode Vent Length Configuration (C02)

Code	Setting	Indoor Model	Configuration Options
C02	0	Default	5-9 ft
	1	Available	9-27 ft
	2	Available	27-45 ft
Notes for Proper Configuration (Indoor):			
1) C02 (Vent Length) MUST be adjusted last. 2) If your application meets the Default criteria, then no adjustment to C02 (Vent Length) is required.			

Cascade Configuration

Use Table 21 below to configure water heaters installed in a Cascade System. See the "Cascade System" section on page 44 for more information on installation and configuration.

IMPORTANT: Each water heater must be properly configured for Altitude (C01), Vent Type (C08) and Vent Length (C02) before linking the units in the Cascade system.

Table 21: C Mode Cascade System (C13 & C14)

Code	Description	Setting	Configuration Options
C13	Number of Child Units in Cascade System	0: 1-11:	No Cascade System (default). Identify number of Child Units. This activates the Cascade System.
C14	Cascade System Heater ID Number	1: 2-12:	Parent Heater (default). Individually set each Child Unit per user preference.

Unit Conversion Mode

Units of measurement can be changed from Imperial to Metric and vice versa. For example, temperature can be changed from °F to °C. Flow rate will also change from gallons per minute to liters per minute when this setting is changed. Follow this procedure to change this setting:

Table 22: Convert Units

	Operation	Screen on the Controller (Built-in & Remote)
1.	Turn on the 120 VAC power supply to the unit. Press the "**ON/OFF**" button on the controller in order to turn the controller on.	
2.	The set point temperature will display. Press and hold the "**SETTING**" button for 5 seconds to access the water heater Adjustment Mode (A Mode).	LONG PRESS 
3.	The display will flash between code "**A00**" and the current set temperature. Press the "**UP**" or "**DOWN**" button once and the display will show code "**A01**." Short press the "**SETTING**" button to show the current temperature setting. The temperature will flash.	SHORT PRESS 
4.	Press the "**UP**" button and the "**DOWN**" button to alternate between Fahrenheit and Celsius.	
5.	Short press the "**SETTING**" button again to execute the change.	SHORT PRESS 
6.	Long press the "**SETTING**" to return the display to normal operation. The new temperature set point will appear in the selected unit (Example: 49°C).	

Regular Maintenance

⚠ WARNING! Turn OFF the electrical power supply and close the manual gas shut-off valve and the manual water control valve before servicing. Failure to do so could result in serious personal injury or death.

The manufacturer recommends having the unit checked once a year or as necessary by a licensed technician or qualified person. If repairs are needed, any repairs should be done by a licensed technician.

Routine maintenance will help your water heater last longer and work better. Failure to perform required or recommended maintenance may void the warranty. If you cannot perform these routine maintenance tasks yourself, contact a qualified person:

- Clean the cold-water inlet filter.
- Be sure that all openings for combustion and ventilation air are not blocked. Any blockages detected **MUST** be removed.
- The venting system for indoor model water heaters should be checked annually for any leaks, corrosion, blockages or damage. Replace any damaged section of venting and clear any blockages.
- The termination screen (if installed in the venting system for indoor model water heaters) **MUST** be inspected regularly that it is not blocked by any object and debris including dust, dirt, snow, etc..
- Keep the area around the water heater and terminations clear. Regularly ensure that the area around the water heater, vent termination, and air intake is free from dust, debris, and other contaminants. Remove any combustible materials, gasoline, flammable vapors, and liquids.
- If the pressure relief valve discharges periodically, it may be due to thermal expansion in a closed water supply system. Contact the water supplier or local plumbing inspector on how to correct this situation.
- The pressure relief valve must be manually operated periodically to check for correct operation. Before operating the valve manually, check that it will discharge in a place for secure disposal.
- If a condensate drain system is installed on an indoor model water heater, then it must be inspected regularly that it drains properly in accordance with local codes or the manufacturer's instructions. If the trap uses water to create the barrier, verify there is sufficient water in the trap loop (Figure 12 & Figure 13).
- The burner should be checked annually for dust, lint, grease or dirt.
- Visually check the burner flames through the burner window (sight glass) on the burner assembly. The burner assembly is located in the middle of the water heater. A properly operating burner should produce clear, blue, stable flames. The flames should not be lifting above the burner. Contaminated air may cause a discolored flame. Contact a qualified technician if the flame is not satisfactory. See Figure 34 below for burner flame reference.

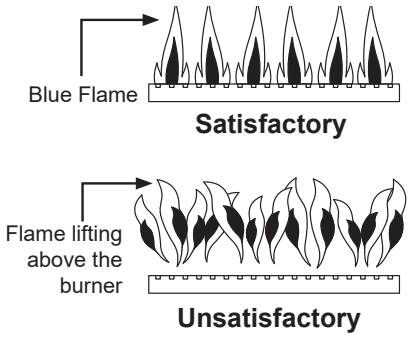


Figure 34 - Check Burner Flames

Freeze Protection System

This unit comes equipped with heating blocks to protect it from damage associated with freezing. The auto-fire mode activates the burner for a short period of time.

For this freeze protection system to operate, there must be electrical power to the unit. Damage to the heat exchanger caused by freezing temperatures due to power loss is not covered under the warranty. In cases where power losses can occur, consider the use of a backup power supply.

It is the installer's responsibility to be aware of freezing issues and take all preventative measures. The manufacturer will not be responsible for any damage to the heat exchanger as a result of freezing.

NOTICE: Only pipes within the water heater are protected by the freeze protection system. Any water pipes (hot or cold) located outside the unit will not be protected. Properly protect and insulate these pipes from freezing. See “Available Accessories” on page 21 for the Cartridge Freeze Protection Kit. This kit is only available for X3® models.

If you will not be using your heater for a long period of time or power has been lost during freezing conditions:

1. Completely drain the water out of the unit. See the "Unit Draining & Power Outage (Freeze Protection)" section on page 53.
2. Disconnect power to your water heater.

Unit Draining & Power Outage (Freeze Protection)

1. Close the manual gas shut-off valve.
2. Disconnect power to the water heater by unplugging it or by turning off the circuit at the breaker box.
3. Close the cold inlet water valve.
4. Open all hot water taps in the house. When the residual water flow has ceased, close all hot water taps.
5. Drain the X3® Cartridge: Have a bucket or pan to catch water from the X3® Cartridge. To remove the X3® Cartridge, remove and keep the 3 screws securing the cartridge in place. Pull down to remove it from the water heater. Empty the water out of the cartridge into the bucket.
6. Wait a few minutes to ensure all water has completely drained from the unit.
7. Keep the cold water valve closed. Keep the gas valve closed. Keep supply power disconnected.
8. To restore the unit to operation, reinstall the X3® Cartridge with 3 screws removed earlier. For detailed instructions, see “X3® Cartridge Installation” on page 36.
9. Open the cold inlet water valve. Check all water connections for leaks. If leaks are found, shut off the cold water inlet valve and immediately fix any leaks. If no leaks are present proceed to the next step.
10. Reconnect power to the water heater.
11. Open the manual gas shut-off to the water heater.
12. If the set temperature is not displayed, press the **ON/OFF** button.

NOTICE: If any errors occur, shut off the water immediately.

Inlet Water Filter

1. Close the manual gas shut-off valve.
2. Disconnect power to the water heater by unplugging it or by turning off the circuit at the breaker box.
3. Close the inlet water valve.
4. Open all hot water taps in the house. When the residual water flow has ceased, close all hot water taps.
5. Drain the X3® (or Bypass) Cartridge: Have a bucket or pan to catch water from the X3® Cartridge. To remove the X3® Cartridge, remove and keep the 3 screws securing the cartridge in place. Pull down to remove it from the water heater. Empty the water out of the cartridge into the bucket.
6. Wait a few minutes to ensure all water has completely drained from the unit.
7. Unscrew the inlet water filter and remove it from the water heater.
8. Clean the filter: Check the water filter located within the cold inlet. With a tiny brush, clean the water filter of any debris which may have accumulated.
9. Screw the inlet water filter back into place. Hand- tighten only.

NOTICE: Handle with care and verify the O-ring is not dirty or damaged.

10. To restore the unit to operation, reinstall the X3® Cartridge with 3 screws removed earlier. For detailed instructions, see “X3® Cartridge Installation” on page 36.
11. Turn **ON** the cold water supply to the water heater at the cold inlet valve. The system will fully pressurize and any leaks at water connections will be apparent. Correct any leaks immediately.
12. Turn **ON** the gas supply to the water heater at the manual gas shut off valve.
13. Restore power to the water heater. The water heater is now ready for operation.

TROUBLESHOOTING

General Troubleshooting

If the water heater is experiencing issues, please check the following. After checking, consult with a qualified person.

Table 23: Troubleshooting Chart

	Problem	Solutions
Temperature and Amount of Hot Water	It takes a long time to get hot water at the fixtures.	• The time it takes to deliver hot water from the water heater to your fixtures depends on the length of piping between the two. The longer the distance or the bigger the pipes, the longer it will take to get hot water. • If you would like to receive hot water to your fixtures more quickly, you may want to consider a hot water recirculation system.
	The water is not hot enough.	• Compare the flow and temperature. • Check cross plumbing between the cold water lines and hot water lines. • Is the gas supply valve open fully? • Is the gas line sized properly? • Is the gas supply pressure sufficient? • Is the temperature setting too low? • Check if the Point-of-Use mixing valves are set correctly, if they are installed. • Are the exhaust and air inlets free of debris? If not, clear the debris and any blockage(s).
	The water is too hot.	• Is the set point temperature set too high?
	The hot water is not available when a fixture is opened.	• Make sure the unit has 120 VAC, 60 Hz power supply. • If you are using the remote controller and/or temperature controller, is the power button turned on? • Is the gas supply valve fully open? • Is the water supply valve fully open? • Is the filter on the cold water inlet clean? • Is the hot water fixture sufficiently open to draw at least 0.4 GPM (1.5 L/min) through the water heater? • Is the unit frozen? • Are the exhaust and air inlets free of debris? If not, clear the debris and any blockage(s).
	The hot water runs cold and stays cold.	• Is the flow rate enough to keep the water heater running? • If there is a recirculation system installed, does the recirculation line have enough check valves? • Is the gas supply valve fully open? • Is the filter on the cold water inlet clean? • Are the fixtures clean of debris and obstructions?
	Fluctuation in hot water temperature.	• Is the filter on the cold water inlet clean? • Is the gas line sized properly? • Is the gas supply pressure sufficient? • Check for cross connection between cold water lines and hot water lines. • If cascaded with multiple heaters, inspect and verify each heater is operating properly within the cascade system.

Table 23: Troubleshooting Chart

	Problem	Solutions
Water Heater	Unit does not ignite when water goes through the unit.	• Is the flow rate over 0.4 GPM (1.5 L/min)? • Check the filter on the cold water inlet. • Check for reverse connections and cross connection. • If you use the remote controller and/or built-in controller, is the power button turned on? • Check if the inlet water temperature is too high. If it is too close to the set temperature, the water heater will not activate.
	The fan motor is still spinning after operation has stopped.	• This is normal. After operation has stopped, the fan motor keeps running to re-ignite quickly, as well as to purge all the exhaust gas out of the flue.
	Unit sounds abnormal while in operation.	• Check all venting and terminations for any blockage and clear. • If other exhaust terminations are nearby, confirm flue gases are not sucked into the water heater's air intake. • Contact Technical Support Department.

Error Codes

The water heater has self-diagnostic functions for safety and convenience when troubleshooting.

If there is a problem with the installation or the unit, the error code associated with that failure will be displayed on the built-in controller or remote controller.

Consult Table 24 on the following pages for the description of each error code.

Single Unit Installation (Example)

If your water heater has the "**E002**" error code (which signifies a high limit break):

- Indicator on the built-in and/or remote controller will display "**E002**" on the screen.

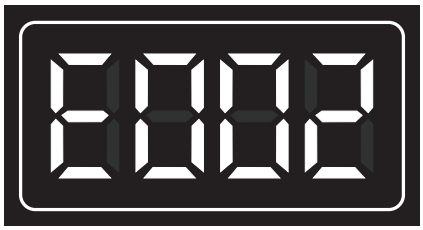


Figure 35 - Single Unit Error Code Example

Cascade System (Example)

Error codes will be displayed differently with units installed within a Cascade System, not only to show what the error code is, but to also indicate which unit within the system has the error code. Below is a sample of how the error code "**E002**" is displayed in a Cascade System.

If Unit #2 has the "**E002**" error code (which signifies a high limit break):

- Indicator on the built-in and/or remote controller of Parent unit will intermittently flash "**E002**" and "**2**."

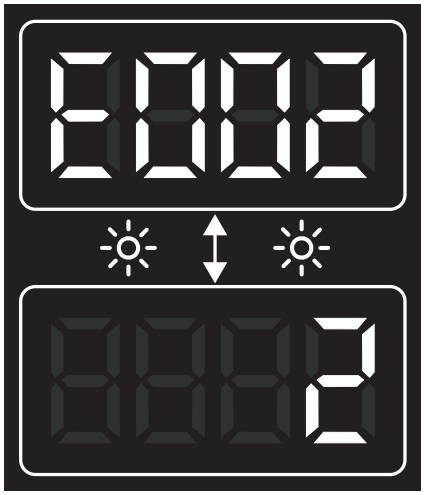


Figure 36 - Cascade System Error Code Example (Parent Unit)

- Child unit #2 will intermittently flash "**E002**" on the display.

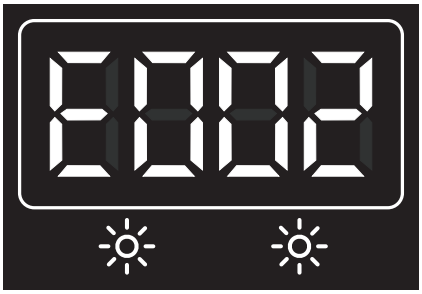


Figure 37 - Cascade System Error Code Example (Child Unit)

- Other Child units will not display anything as the error code does not pertain to them.

Fault Analysis of Error Codes

If the water heater is displaying an error code, please check the following. After checking, consult with the manufacturer.

Table 24: Error Code Fault Analysis

Error Code	Error Description	Procedure
E002	High Limit Break	Manual Hi-Limit Switch located on heat exchanger tripped. Check Hi-limit switch for proper operation. Pressing the reset button (center of the switch), will reset the Hi-limit switch. **NOTICE:** If the Hi-Limit switch has tripped, you will hear and feel it click when resetting it. If the high limit switch continues to trip, contact a qualified service technician.
E006	PCB Hardware Fault - Ad Converter Fault	Check PCB wiring for loose, damaged or cut wires/connectors. Correct any loose connection and replace any damaged wires/connectors. If all wires/connectors are intact, replace the PCB.
E010	Frequency Fault	PCB has detected an incorrect power supply frequency. Note the default frequency is 60 Hz. See instructions on page 50 to access C Mode. Confirm C07 displays 60. If the setting is correct and the error still occurs, contact a qualified service technician.
E011	PCB Hardware Fault - Memory Error	The water heater will continue to operate while this error code is flashing. If this heater is part of a cascade system, then the system will be affected based on the heater's setting. • Parent Heater: The cascade system will not operate. Remove this heater from the cascade system and set a different heater as the Parent. • Child Heater: This heater will not operate. The rest of the cascade system will continue to run.
E036	Flame Failure	**WARNING! Working on an energized circuit can result in severe injury or death from electrical shock.** Check the flame sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E037	False Flame Detection (During Standby)	**WARNING! Working on an energized circuit can result in severe injury or death from electrical shock.** 1. Check for a visible flame through the sight glass while water is not running through the water heater. If the error still occurs, immediately shut off the water heater and contact a qualified service technician. 2. Check the flame sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.

TROUBLESHOOTING

Table 24: Error Code Fault Analysis

Error Code	Error Description	Procedure
E038	Ignition Failure	**WARNING! Working on an energized circuit can result in severe injury or death from electrical shock.** 1. Check for a visible flame through the sight glass. 2. Check the flame sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E041	Outlet Water Over-temp	1. Verify the thermistor reading with the water outlet temperature. 2. Remove the outlet thermistor (do not lose the O-ring) and check for any dirt or debris. Clean with an Emery cloth. If the thermistor is damaged, replace it. If the error still occurs, contact a qualified service technician.
E049	Fan Thermistor Failure	1. Remove the thermistor (do not lose the O-ring) and check for any dirt or debris. Clean with an Emory cloth. If the thermistor is damaged, replace it. 2. Check the Thermistor sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E050	Inlet Thermistor Failure	1. Remove the thermistor (do not lose the O-ring) and check for any dirt or debris. Clean with an Emory cloth. If the thermistor is damaged, replace it. 2. Check the Thermistor sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E051	Outlet Thermistor Failure	1. Remove the thermistor (do not lose the O-ring) and check for any dirt or debris. Clean with an Emory cloth. If the thermistor is damaged, replace it. 2. Check the Thermistor sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E052	Heat Exchanger Thermistor Failure	1. Remove the thermistor (do not lose the O-ring) and check for any dirt or debris. Clean with an Emory cloth. If the thermistor is damaged, replace it. 2. Check the Thermistor sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E380	Incorrect Setting	Contact a qualified service technician to replace the PCB.

Table 24: Error Code Fault Analysis

Error Code	Error Description	Procedure
E381	Combustion Blockage	1. With the water heater power disconnected, check the exhaust vent and air intake piping for any blockages. Remove any blockages. 2. For indoor models, verify the water heater has sufficient combustion air. Reference the "Venting (Indoor Model)" section on page 24 of the manual. 3. If the error still occurs, contact a qualified service technician.
E382	Abnormal Proportional Valve Current	Check the proportional valve wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E383	Inlet Water Over-temp	1. Verify the inlet water temperature is not above the water heater's set temperature or above 122°F. 2. Remove the thermistor (do not lose the O-ring) and check for any dirt or debris. Clean with an Emory cloth. If the thermistor is damaged, replace it. 3. Check the Thermistor sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E385	Main Gas Solenoid Valve Drive Circuit Failure	Check the gas valve wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E388	Bypass Valve Fault	1. Correct any loose connection and replace any damaged wire/connector. 2. Follow the draining procedure on page 53 to properly drain the water heater. Remove the bypass valve and inspect for any debris or damage. Replace if needed.
E389	Fan Current AD Failure	Contact a qualified service technician to replace the PCB.
E390	Fan Over Max Current (During Standby)	Check the fan motor wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E391	Fan Over Max Current (During Operation)	Check the fan motor wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E392	Fan False Start (During Operation)	Check the fan motor wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E393	Fan Signal Loss	Check the fan motor wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E394	Fan Target Speed	1. Check the fan motor wiring. Correct any loose connection and replace any damaged wire/connector. 2. With the water heater power disconnected, check the exhaust vent and air intake piping for any blockages. Remove any blockages. If the error still occurs, contact a qualified service technician.

TROUBLESHOOTING

Table 24: Error Code Fault Analysis

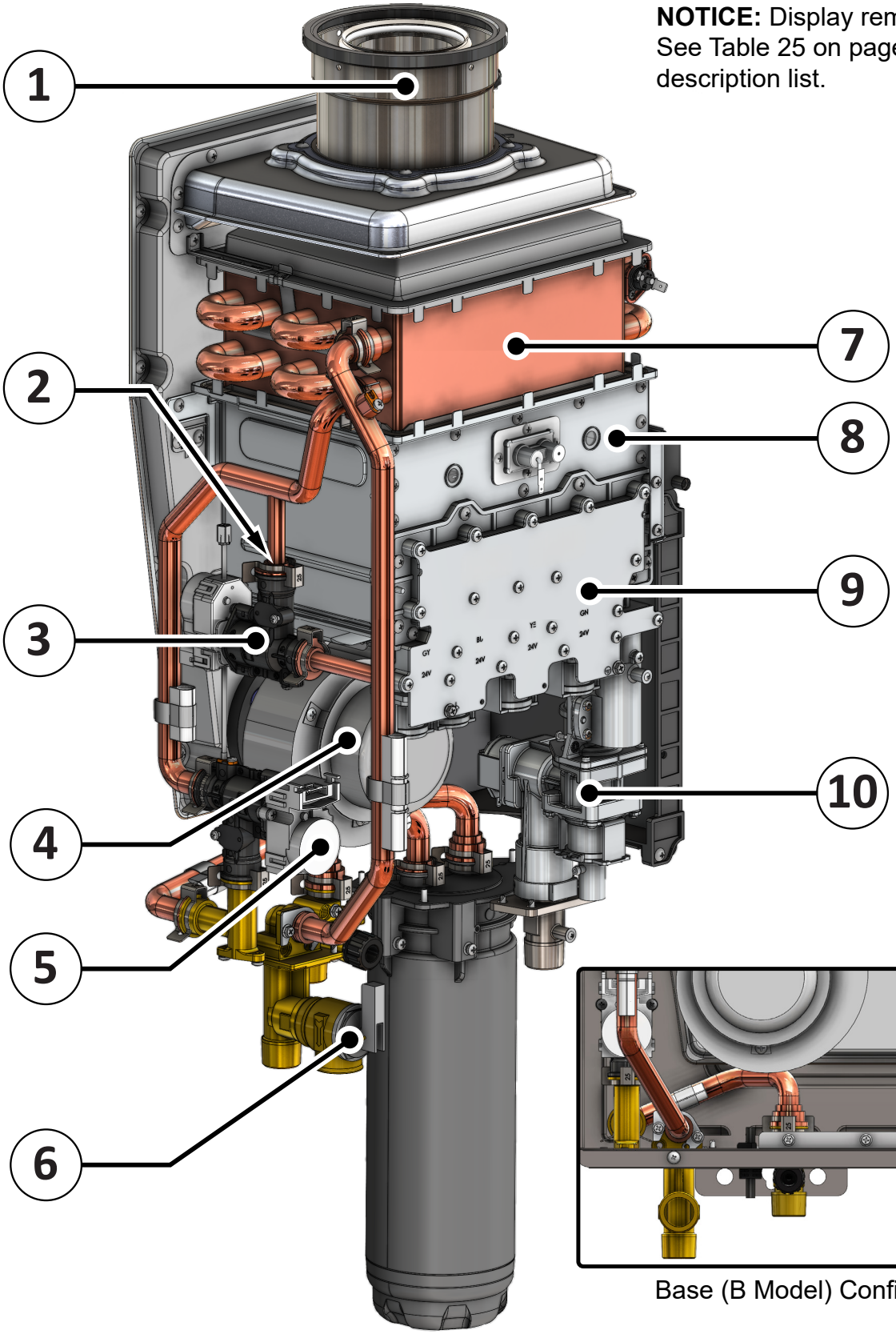
Error Code	Error Description	Procedure
E395	Fan Current without Drive (During Standby)	Check the fan motor wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E400	Communication Fault with UIM (Indoor Model Only)	Check the UIM wiring. Correct any loose connection and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician.
E401	Communication Fault with Remote Controller	1. Check the Remote Controller wiring. Correct any loose connections and replace any damaged wire/connector. 2. Only one remote controller can be installed, remove any additional remote controllers. 3. If the error still occurs, contact a qualified service technician.
E402	Communication Fault in Cascade System	1. Check the Cascade wiring. Correct any loose connections and replace any damaged wire/connector. 2. Cycle the heater's power **OFF/ON** if the cascade wiring was disconnected while the system still had power. 3. If the error still occurs, contact a qualified service technician.
E404	Inconsistent Models in Cascade-Link	Confirm all units in Cascade System are the same model. All models in the cascade system must be the same.
E412	PCB Hardware Fault - Flame Circuit Failure	Contact a qualified service technician to replace the PCB.
E413	Flame Sensor Fault	1. Check the flame sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. 2. With the water heater power disconnected, check the exhaust vent and air intake piping for any blockages. Remove any blockages. 3. For indoor models, verify the water heater has sufficient combustion air. Reference the "Venting (Indoor Model)" section on page 24 of the manual. 4. Check the installation area for corrosive elements. Reference the Installation Environment section in the manual. 5. If the error still occurs, contact a qualified service technician.
E414	PCB - Flame Sensor Circuit	1. Check the flame sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. 2. If the error still occurs, contact a qualified service technician to replace the PCB.

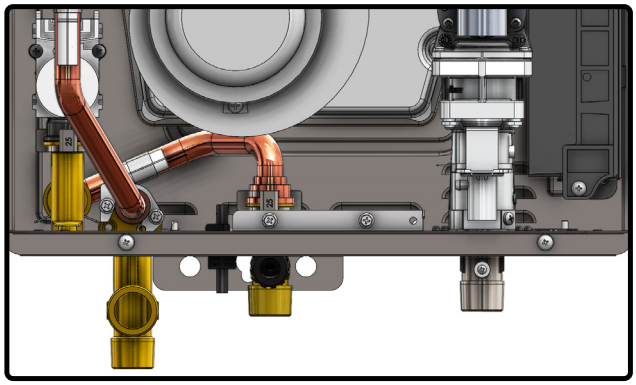
Table 24: Error Code Fault Analysis

Error Code	Error Description	Procedure
E416	Analog/Digital (AD) Value Fault	1. Check the outlet thermistor sensor wire for a short or disconnection. Correct any loose connections and replace any damaged wire/connector. If the error still occurs, contact a qualified service technician. 2. Remove the outlet thermistor (do not lose the O-ring) and check for any dirt or debris. Clean with an Emery cloth. If the thermistor is damaged, replace it. 3. If the error still occurs, contact a qualified service technician to replace the PCB.
E419	Flame Signal Lost	1. Check the flame sensor wire for a short or disconnection. Correct any loose connection and replace any damaged wire/connector. 2. With the water heater power disconnected, check the exhaust vent and air intake piping for any blockages. Remove any blockages. If the error still occurs, contact a qualified service technician. 3. If the error still occurs, contact a qualified service technician.
E427	Flow Control Valve	1. Check the flow control valve wires for a short or disconnection. Correct any loose connections and replace any damaged wire/connector. 2. Remove the flow control valve and inspect for any debris or damage. Replace if needed. First follow the draining procedure in the Unit Draining & Power Outage section in this manual.
E428	Flow Sensor - Cascade Only	1. Verify the water heater's operation is enabled. The heater's UIM will display the set temperature when enabled. If it is disabled, press the heater's **ON/OFF** button to enable the heater's operation. 2. Verify that the heater's water shutoff valves are open. 3. Check the flow sensor wires for a short or disconnection. Correct any loose connections and replace any damaged wire/connector. 4. Drain the water heater following Unit Draining & Power Outage section in this manual. 5. Remove the flow sensor and inspect for any debris or damage. Replace if needed. 6. Remove and clean the inlet water filter.
E429	Flow Control Valve Fault - Cascade Only	1. Check the flow control valve wires for a short or disconnection. Correct any loose connections and replace any damaged wire/connector. 2. Remove the flow control valve and inspect for any debris or damage. Replace if needed. First follow the draining procedure in the Unit Draining & Power Outage section in this manual.

Component View (Indoor Model)

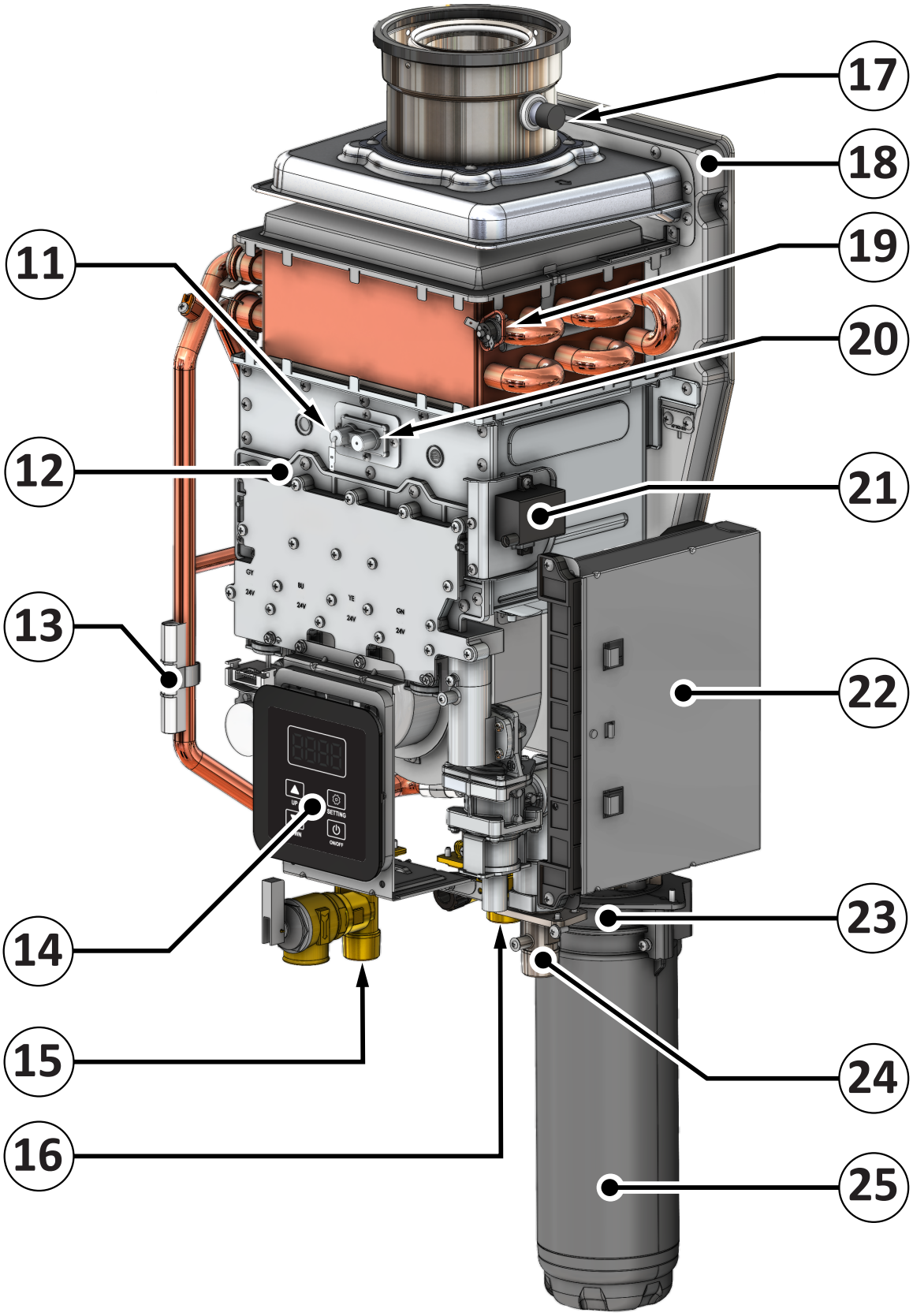
NOTICE: Display removed for clarity. See Table 25 on page 64 for parts description list.





Base (B Model) Configuration

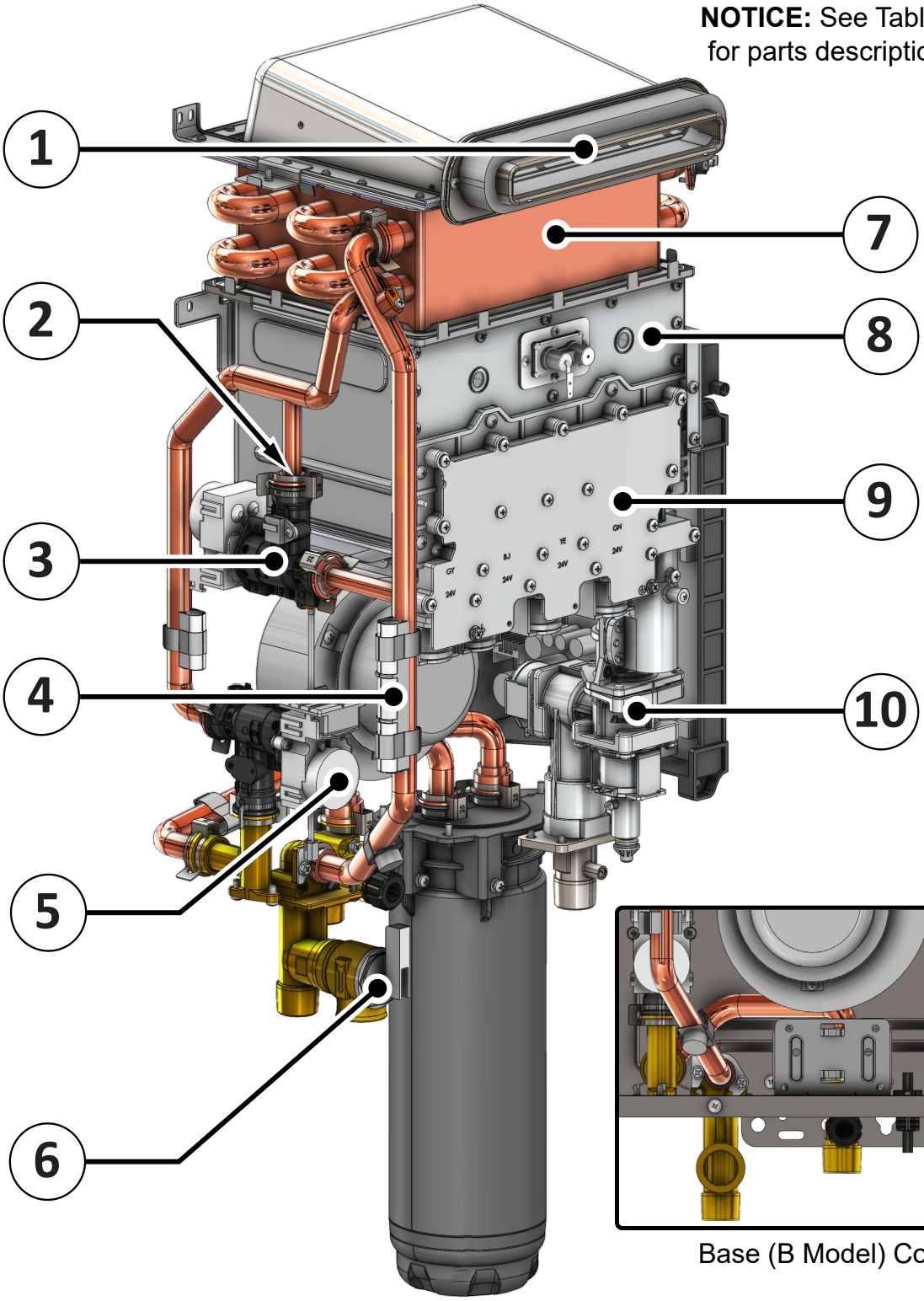
Component View (Indoor Model)

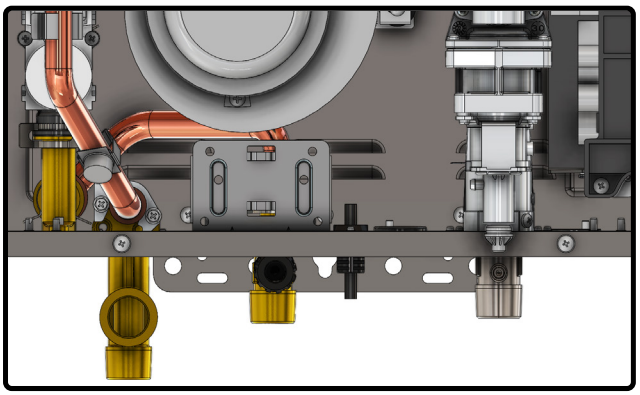


COMPONENTS

Component View (Outdoor Model)

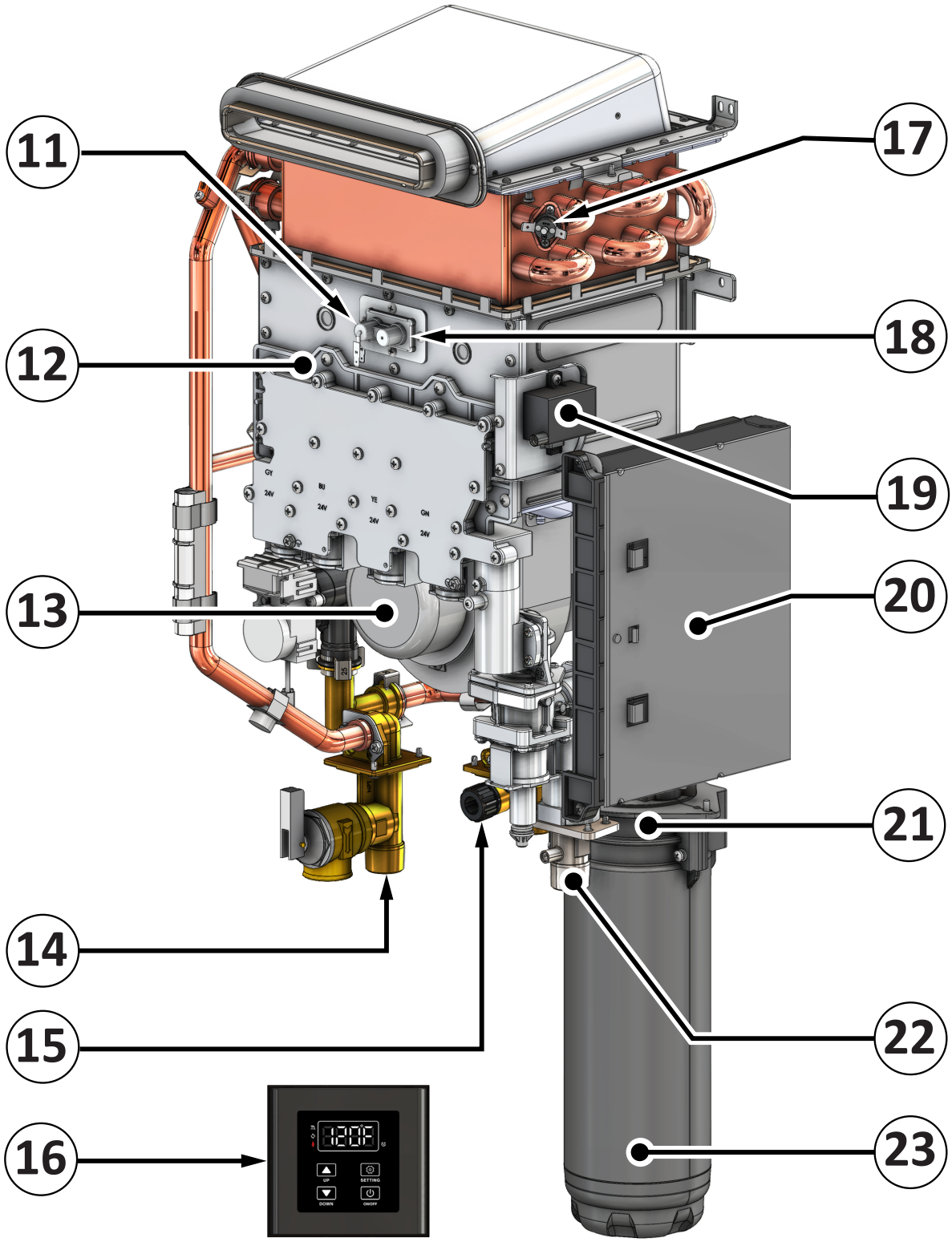
NOTICE: See Table 26 on page 64 for parts description list.





Base (B Model) Configuration

Component View (Outdoor Model)



COMPONENTS

Components List

When ordering repair parts, always give the following information:

1. Model, serial, and product number
2. Item number
3. Parts description

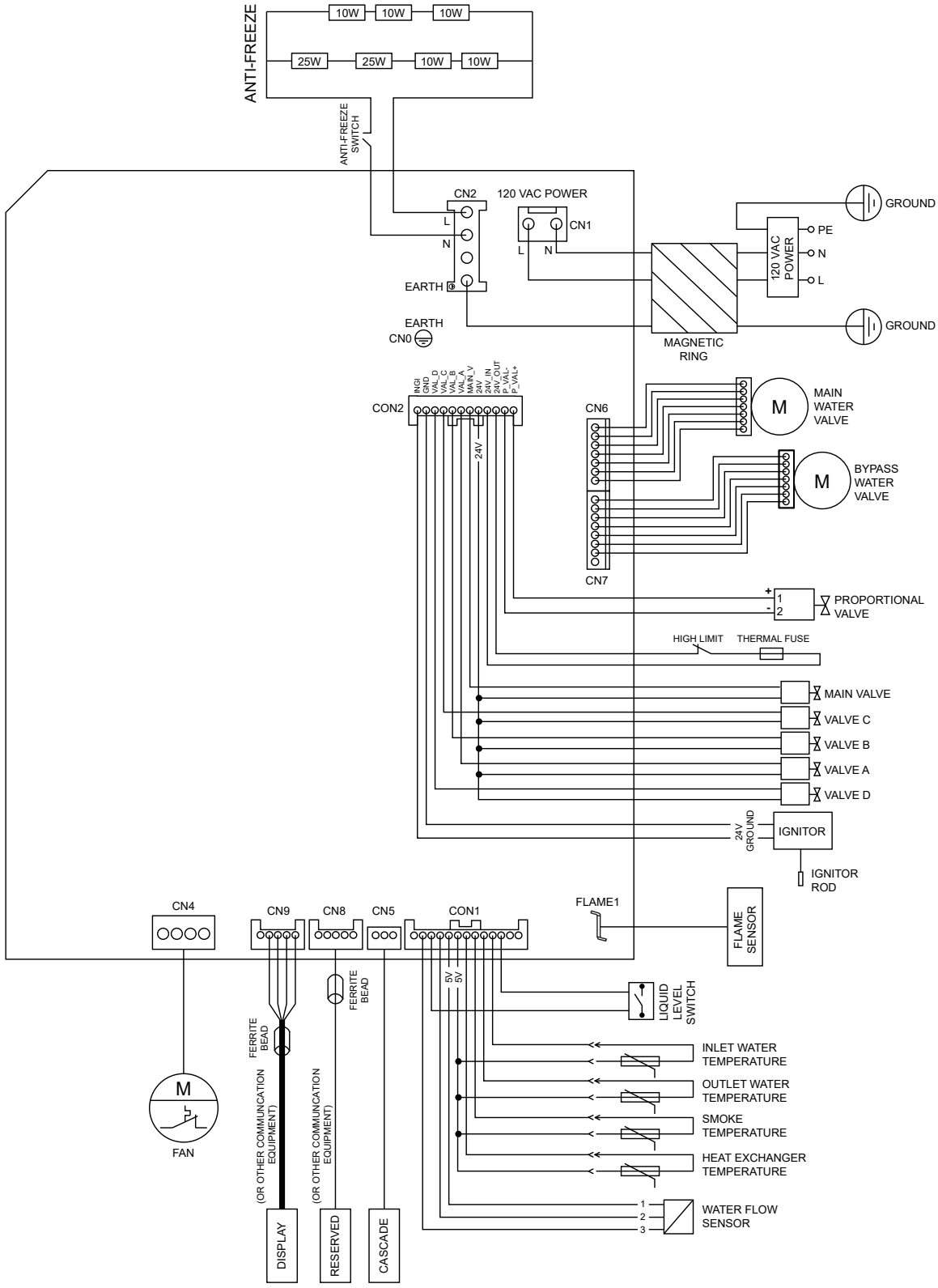
Table 25: Repair Parts List (TI Indoor Model)

Item No.	Parts Description (Indoor Model)
1	3" Exhaust / 5" Intake Connection
2	Water Tube Retaining Clip
3	Bypass Water Valve
4	Blower
5	Main Water Valve
6	Pressure Relief Valve
7	Heat Exchanger
8	Burner
9	Gas Manifold Cover
10	Gas Valve
11	Flame Sensor Rod
12	Gas Manifold
13	Freeze Protection
14	User Interface Module (UIM)
15	Hot Water Outlet
16	Cold Water Inlet
17	Venting Condensate Drain Port
18	Air Intake Plenum
19	Hi-Limit Switch
20	Ignitor Rod
21	Ignitor Assembly
22	Printed Circuit Board (PCB)
23	Cartridge Manifold (X3® shown)
24	3/4" Gas Connection
25	X3® Cartridge (X3® shown)

Table 26: Repair Parts List (TO Outdoor Model)

Item No.	Parts Description (Outdoor Model)
1	Exhaust
2	Water Tube Retaining Clip
3	Bypass Water Valve
4	Freeze Protection
5	Main Water Valve
6	Pressure Relief Valve
7	Heat Exchanger
8	Burner
9	Gas Manifold Cover
10	Gas Valve
11	Flame Sensor Rod
12	Gas Manifold
13	Blower
14	Hot Water Outlet
15	Cold Water Inlet
16	Remote Controller
17	Hi-Limit Switch
18	Ignitor Rod
19	Ignitor Assembly
20	Printed Circuit Board (PCB)
21	Cartridge Manifold (X3® shown)
22	3/4" Gas Connection
23	X3® Cartridge (X3® shown)

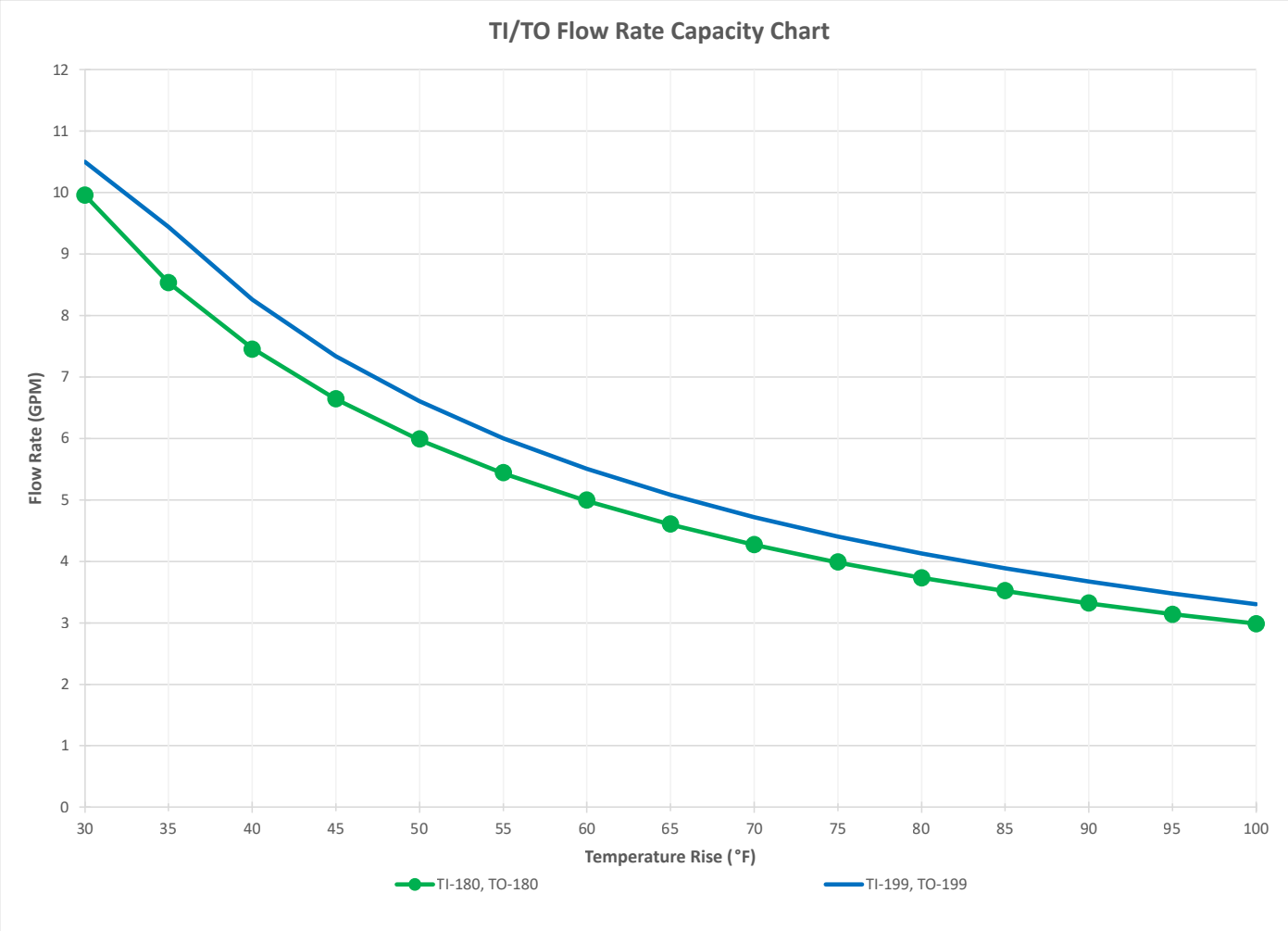
Electrical Wiring Diagram



APPENDIX

Flow Rate Capacity Chart

The chart is based on a properly sized gas line and installation at 0-2,000 ft. (0-610 m). The water heater will de-rate approximately 3% (NG) per 1,000 ft. (305 m) of elevation increase above 2,000 ft. (610 m).



NOTES

NOTES

NOTES

Copyright © 2025, A.O. Smith.
All Rights Reserved