

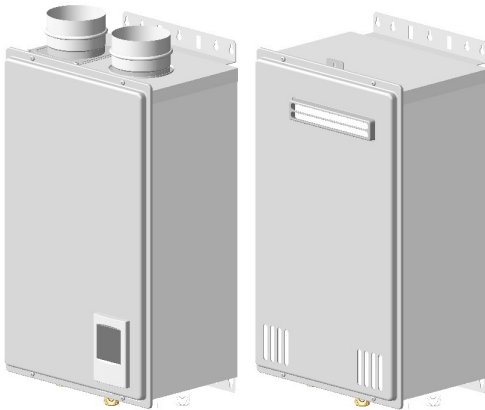
On-Demand Water Heater Installation Manual and Owner's Guide



ANSI Z21.10.3 • CSA 4.3

Model

- 140 Indoor
- 140 Outdoor



Gas Tankless Water Heater™

Suitable for combination potable water heating and space heating. Please refer to local codes for space-heating compliance.

FEATURING

- ENDLESS HOT WATER
- ON-DEMAND USAGE
- COMPACT, SPACE SAVING
- ENERGY CONSERVATION
- COMPUTERIZED SAFETY
- NO PILOT LIGHT
- Complies with SCAQMD Rule 1146.2 for natural gas Low NOx Emissions of 14 ng/J or 20 ppm.



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 electric switch, do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

If you have any questions, please
call or write to:

500 Tennessee Waltz Parkway
Ashland City, TN 37015
Toll Free: 1-877-737-2840

Keep this manual near the water heater for future reference whenever maintenance, adjustment, or service is required.

CONTENTS

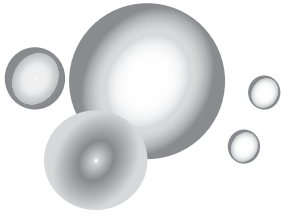
Installation Manual

SPECIFICATIONS	4
INTRODUCTION	5
SAFETY GUIDELINES	6
SAFETY DEFINITION	6
GENERAL	6
INSTALLATION	7
GENERAL	7
CLEARANCES	9
INCLUDED ACCESSORIES	9
OPTIONAL ITEMS	9
WARNING FOR INSTALLATIONS	11
HIGH-ALTITUDE INSTALLATIONS	12
VENTING INSTRUCTIONS	13
General	13
Combustion air supply	14
Exhaust vent (ABS,PVC,CPVC, or polypropylene vent)	18
DIP switch settings for vent length (ABS,PVC,CPVC, or polypropylene vent)	19
Exhaust vent (Stainless steel vent)	22
DIP switch settings for vent length (Stainless steel vent)	23
Vent termination clearances	25
Clearances for sidewall terminations	26
Clearances for rooftop terminations	27
GAS SUPPLY AND GAS PIPE SIZING	28
General	28
Gas connections	28
Natural Gas supply piping	29
Propane (LP) supply piping	29
WATER CONNECTIONS	30
Pressure relief valve	30
CONDENSATE DRAIN	31
Condensate drain connections	31
ELECTRICAL CONNECTIONS	33
TEMPERATURE REMOTE CONTROLLER	33
Included accessories	33
Installation	34
APPLICATIONS	35
Space heating applications	35
Recirculation	35
Dual-purpose hot water heating	36
INITIAL OPERATION	37

Owner's Guide

OPERATING SAFETY	39
NORMAL OPERATION	41
BUILT-IN AND REMOTE CONTROLLER	41
GENERAL	41
TEMPERATURE TABLE OF CONTROLLER	41
OUTLET WATER TEMPERATURE SETTING	42
Using controller	42
Temperature setting on the PCB	42
ADDITIONAL FEATURES	43
Information mode	43
Unit conversion mode	43
FLOW	44
FREEZE PROTECTION SYSTEM	44
MAINTENANCE AND SERVICE	44
Measuring inlet gas pressure	45
UNIT DRAINING AND FILTER CLEANING	45
TROUBLESHOOTING	46
ERROR CODES	47
Fault analysis error code	48
COMPONENTS DIAGRAM	50
PARTS LIST	54
OUTPUT TEMPERATURE CHART	56

This installation manual is approved for installation in the United States.



Installation Manual

CONGRATULATIONS

Congratulations and thank you for choosing our tankless water heater. Before use, we recommend that you read through this installation manual carefully. Keep this manual for future reference.

If you need an additional manual, contact the manufacturer or your local distributor. When you call, please tell us the product name and the serial number of your unit written on the rating plate of the water heater.

SPECIFICATIONS

Model			140 Indoor		140 Outdoor	
Natural Gas Input (Operating Range)		BTU/h	Min.: 15,000 Max.: 120,000			
Propane Input (Operating Range)		BTU/h	Min.: 15,000 Max.: 120,000			
Gas Connection			1/2" NPT			
Water Connection			3/4" NPT			
Water Pressure*		psi (MPa)	15 - 150 (0.1 - 1.0)			
Natural gas Inlet Pressure		inch W.C. (kPa)	Min. 4.0 (1.0) Max. 10.5 (2.6)			
Propane Inlet Pressure		inch W.C. (kPa)	Min. 8.0 (2.0) Max. 14.0 (3.5)			
Weight		lbs. (kg)	50 (22.5)		50 (22.5)	
Dimension		inch	H 21-3/4 x W 14 x D 9-1/4 H 552 x W 352 x D 236			
		mm				
Ignition			Electric Ignition			
Electric	Supply		VAC / Hz		120 / 60	
	Consumption	Operation	W / A		53.9 / 0.7	
		Standby	W / A		3.2 / 0.05	
		Freeze-Protection	W / A		223.9 / 1.94	
Water heater category**			Category IV		N/A	

*40 psi or above is recommended for maximum flow.

****Water heater Category** — water heaters of other than direct vent type, for outdoor installation, are divided into four categories based on static pressure produced in the vent and flue loss.

Category I - a water heater that operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

Category II - a water heater that operates with a non-positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

Category III - a water heater that operates with a positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

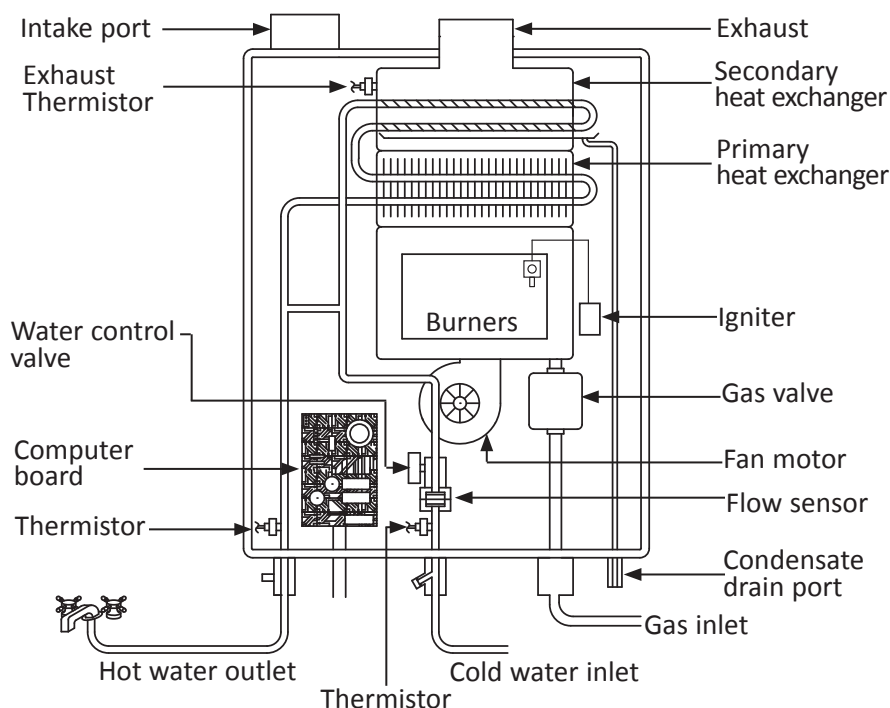
Category IV - a water heater that operates with a positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

NOTE:

- Check the rating plate to ensure that this product matches your specifications.
- **The manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligation.**

INTRODUCTION

- This manual provides information necessary for the installation, operation, and maintenance of the water heater.
- The model description is listed on the rating plate which is attached to the side/front panel of the water heater.
- Please read all installation instructions completely before installing this product.
- If you have any problems or questions regarding this equipment, consult the manufacturer or its local representative.
- This equipment is an on-demand, tankless water heater designed to efficiently supply endless hot water for your needs.
- These **high efficiency models** have a built-in secondary heat exchanger that absorbs latent heat from the exhaust gas.
- The 140 Indoor model is only to be installed indoors. The 140 Outdoor model is only to be installed outdoors.
- The principle behind tankless water heaters is simple:



*This diagram illustrates tankless water heater design concepts only and does not accurately represent the water heater's physical description.

1. A hot water fixture is turned on.
2. Water flows through the heater.
3. The water flow sensor detects the water flow.
4. The computer initiates the fan motor and gas valve to let gas flow through the heater and sends a signal to the igniter to create an ignition spark.
5. The gas ignites and flames appear within the burner chamber.
6. Water is heated as it flows through the heat exchanger.
7. Using thermistors to measure temperatures throughout the water heater, the computer modulates the gas and water valves to ensure proper output water temperature and hot water outflows.
8. When the fixture is turned off, the unit shuts down.

SAFETY GUIDELINES

SAFETY DEFINITION



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury.



Indicates an imminently hazardous situation which, if not avoided, could result in minor or moderate injury.



Indicates information considered important but not hazard related.

GENERAL

1. Follow all local codes, or in the absence of local codes, follow the current edition of the National Fuel Gas Code: ANSI Z223.1/NFPA 54 in the USA or B149.1 Natural Gas, Propane Installation Code in Canada.
2. Properly ground the unit in accordance with all local codes or in the absence of local codes, with the National Electrical Codes: ANSI/NFPA 70 in the USA or CSA standard C22.1 Canadian Electrical Code Part 1 in Canada.
3. Carefully plan where you intend to install the water heater. Please ensure:
 - Your water heater will have enough combustible air and proper ventilation.
 - Locate your heater where water leakage will not damage surrounding areas. (Please refer to p. 8.)
4. Check the rating plate for the correct **GAS TYPE, GAS PRESSURE, WATER PRESSURE and ELECTRIC RATING**.
*If this unit does not match your requirements, **do not install and consult with the manufacturer**.
5. If any problem should occur, turn off all hot water taps and turn off the gas. Then call a trained technician, the gas company, or the manufacturer.



- Water temperatures over 125 °F (52 °C) can cause severe burns instantly or death from scalding. The water temperature is set at 120 °F (50 °C) from the factory to minimize any scalding risk. Before bathing or showering always check the water temperature.
- Do not store or use gasoline or other flammables, vapors, or liquids in the vicinity of this appliance.
- Do not reverse the water and/or gas connections as this will damage the gas valves and can cause severe injury or death. Follow the diagram on p. 30 when installing your water heater.
- Should overheating occur or the gas supply fails to shut off, turn off the manual gas control valve to the 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.
- Do not disconnect the electrical supply if the ambient temperature will drop below freezing. The Freeze Protection System only works if the unit has electrical power. The warranty will not be covered if the heat exchanger is damaged due to freezing. Refer to the section on the Freeze Protection System on p. 44 for more information.
- Failure to observe these warnings could result in severe personal injury or death.

INSTALLATION

GENERAL

1. Follow all local codes, or in the absence of local codes, follow the current edition of the National Fuel Gas Code: ANSI Z223.1/NFPA 54 in the USA or B149.1 Natural Gas, Propane Installation Code in Canada.
2. All gas water heaters require careful and correct installation to ensure safe and efficient operation. This manual must be followed exactly. Read the "Safety Guidelines" section.
3. The manifold gas pressure is preset at the factory. It is computer controlled and should not need adjustment.
4. Maintain proper space for servicing. Install the water heater so that it can be connected or removed easily. Refer to the "Clearances" section on p. 9 for proper clearances.
5. The water heater must be installed in a location where the proper amount of combustible air will be available to it at all times without obstructions, or the indoor heater may be direct vented.
6. Electrical service to the water heater requires a means of disconnection. This will allow power to the water heater to be shut off for servicing and safety purposes.
7. 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. (Refer to pp. 11, 25 and 26.) Check local code requirements prior to installation.
8. Carefully plan the installation location of the heater and vent terminations. Contaminants such as aerosols, lint, and fine powders (including flour) can clog the air intake and reduce the operation of the fan. This, in turn, can cause improper combustion and reduce the life of the water heater. Regularly ensure that the area around the water heater, vent termination, and air intake is free of dust, debris, and other contaminants. In environments with a high level of contaminants (laundry facilities, hair salons, pet salons, chemical plants, commercial kitchens, etc.), direct venting is required.
9. The 140 Indoor model is to be installed indoors only. The model is equipped with a thermistor and hi-limit switch for the exhaust gas, detecting excess temperatures within the flue and enabling the water heater to safely stop operation if needed. These components are always monitoring exhaust gas conditions in order to prevent heat damage to ABS, PVC (solid core), CPVC (solid core), or Polypropylene (Plastic) venting if ABS, PVC, CPVC, or Polypropylene is used. If the exhaust gas temperature exceeds 140 °F (60 °C) these components will enable the water heater to safely stop operation. (These components are not installed on the outdoor model since the exhaust vent is built-in.)
 - If the water heater is used as a direct-vent appliance, the unit requires 3 in (76 mm) or 4 in (102 mm) combustion air supply pipe. The intake pipe must be sealed airtight. Refer to pp. 13 to 27 for more detail.
 - Air supply pipe can be made of aluminum flexible tube, ABS, PVC (solid core), CPVC (solid core), Polypropylene, corrugated stainless steel, or Category III / IV stainless steel. Regarding exhaust pipe, please refer to pp.18 to 24 for detailed information.
 - Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenylsulfone) in non-metallic venting systems is prohibited. Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.
 - Terminating the venting through a sidewall is recommended for the direct-vent system. Terminating in the same pressure zone allows for pressure balancing, which prevents nuisance shutdowns.
 - Only install the water heater in a heated area where below freezing temperatures cannot occur. The warranty does not cover damage caused by freezing.
 - The manufacturer recommends running the exhaust vent and the intake pipe as parallel as possible.
 - The water heater must be securely mounted to a wall or other suitable structure.
10. The 140 Outdoor model must only be installed outdoors and only in the area with mild, temperate climates. The Outdoor model shall be wall-mounted or mounted on a stand. Locate the Outdoor model in an open, unroofed area and maintain the minimum clearances. (Refer to pp.9 and 11.)



WARNING

- Installation and service must be performed by a qualified installer (for example, a licensed plumber or gas fitter). Otherwise, the warranty will be void.
- The installer (licensed professional) is responsible for the correct installation of the water heater and for compliance with all national, state/provincial, and local codes.
- The manufacturer does not recommend installing the water heater in a pit or location where gas and water can accumulate.
- Do not have the vent terminal pointing toward any operating window, door, or opening into a building.
- Do not install next to any source of airborne debris, such as a clothes dryer, that can cause debris to be trapped inside the combustion chamber, unless the system is direct-vented.
- Do not install the unit where water, debris, or flammable vapors may get into the flue terminal or the air intake line.
- **The manufacturer does not recommend installing the water heater in an attic due to safety issues.** If you install the water heater in an attic:
 - Make sure the unit will have enough combustion air and proper ventilation. Failure to do so could lead to carbon monoxide poisoning or death.
 - Keep the area around the water heater clean. When dust collects on the flame sensor, the water heater will shut down on an error code.
 - Place the unit where it will allow easy access for service and maintenance.
 - A drain pan, or other means of protection against water damage, is recommended to be installed under the water heater in case of leaks.
- **Failure to observe these warnings could result in severe personal injury, death, and/or property damage.**

NOTICE

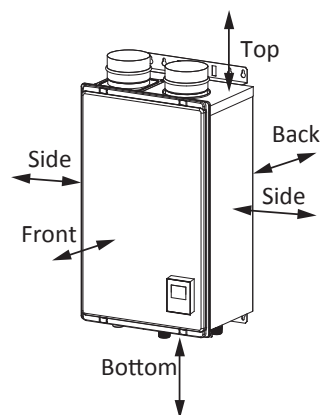
- **The warranty will not cover damage caused by water quality.**
 - Only potable water can be used with this water heater. Do not introduce pool or spa water, or any chemically treated water into the water heater.
 - Water hardness levels must not exceed 7 grains per gallon (120 ppm) for single family domestic applications or more than 4 grains per gallon (70 ppm) for all other types of applications. Water hardness leads to scale formation and may affect/damage the water heater. Hard water scaling must be avoided or controlled by proper water treatment.
 - Water pH levels must be between 6.5 and 8.5.
 - Well water must be treated.
- **The manufacturer recommends direct venting when the water heater is installed in beauty salons, dry cleaners or any other locations in which such chemicals are present in the air.** Some chemicals used in beauty salons or dry cleaners may affect the flame sensor. In such cases, the water heater may not work properly.
- Although the water heater is designed to operate with minimal sound, **the manufacturer does not recommend installing the unit on a wall adjacent to a bedroom, or a room that is intended for quiet study or meditation, etc.**
- Locate your 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. The manufacturer will not be responsible for any water damage that may occur. If you install a drain pan under the unit, ensure that it will not restrict the combustion air flow.

CLEARANCES



WARNING

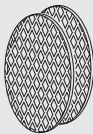
Maintain all clearances around the water heater. Failure to do so could create a fire hazard, potentially leading to death, serious injury, and/or property damage.



Model	Top	Bottom	Front	Back	Sides
140 Indoor	12 in. (305 mm)	12 in. (305 mm)	4 in.* (102 mm)	1 in. (25 mm)	3 in. (76 mm)
140 Outdoor	36 in. (914 mm)	12 in. (305 mm)	24 in. (610 mm)	1 in. (25 mm)	3 in. (76 mm)

*24 inches recommended for maintenance.

INCLUDED ACCESSORIES

Installation manual and owner's guide	Temperature remote controller kit* Outdoor model only	Bird screen Indoor model only
 Qty: 1	 100209924 (TM-RE42) Qty: 1	 Qty: 2

OPTIONAL ITEMS

#	Model	140 Indoor	140 Outdoor
1.	Temperature Remote Controller	✓	Included with the water heater
2.	Pipe Cover	✓	✓
3.	Neutralizer Kit	✓	✓
4.	4-inch Exhaust Sidewall Vent Terminator (Hood) and 4-inch Wall Thimble	✓	
5.	3-inch Concentric PVC Termination	✓	
6.	Recess Box		✓

**1. Temperature remote controller:
100209924 (TM-RE42)-Standard model**

The temperature remote controllers have three functions. It allows the output temperature from the water heater to be adjusted. It also works as a diagnostic tool and provides a concise error code whenever there is a problem with the unit. See the Troubleshooting Section (pp.53 to 56) for information on possible error codes.



**2. Pipe cover:
100187904 (TH-PC04)**

The pipe cover protects the plumbing pipes to the water heater from unexpected adjustments. This pipe cover is fixed to the bottom of the water heater, which hides the plumbing and improves the visual aspects of the whole installation.



3. Neutralizer kit: 100112159 (TH-NT01)

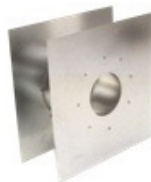
The neutralizer assembly neutralizes the condensate (acidic water) that forms in the secondary heat exchanger of the water heater. It connects to the condensate drain port of the water heater with connectors included with the neutralizer kit. (Refer to pp. 32 and 33.)



4. Sidewall vent terminator (Hood) and Wall thimble:



Terminator Hood



Wall Thimble

Covering wall thicknesses	Part#
Terminator Hood	100112419
Wall Thimble 4 - 7 in (102 - 178 mm)	100112732
Wall Thimble 5 - 10 in (123 - 254 mm)	100112733
Termination + Thimble 4 - 7 in (102 - 178 mm)	100112424
Termination + Thimble 5 - 10 in (123 - 254 mm)	100112425

These are used when venting out through the wall. These terminations are special stainless steel vents for gas appliances and are UL listed as Category II, III and IV. For different wall thicknesses, there are two ranges of lengths available. (Refer to the NovaVent brochure for details.) Install these vent terminations in accordance with their installation instructions and any applicable local codes.

5. 3" PVC concentric termination: 100112163 (TH-CVPVC33)



Used when terminating direct-vent (sealed combustion) systems, with Indoor models that require a 3 in. (76 mm) intake and a 3 in. (76 mm) exhaust.

This concentric termination provides the convenience of only having to make one penetration through a sidewall instead of two separate penetrations for the intake and exhaust piping. The termination includes a bird screen, restricting small animals, pests, and foreign objects from entering into the vent system.

6. Recess box:

It allows for "clean" installations. The water heater fits inside the recess box, which hides and protects the whole water heater and plumbing. The recess box will fit between most wall studs.



100266729

Outdoor recess box
for retrofit applica-
tions-no flange



100266730

Outdoor recess box
for new construc-
tion applications-
with flange

WARNING FOR INSTALLATIONS

FOR YOUR SAFETY, READ BEFORE INSTALLATION:

Do not install the heater where water, debris or flammable vapors may get into the flue terminal. This may cause damage to the heater and void the warranty.



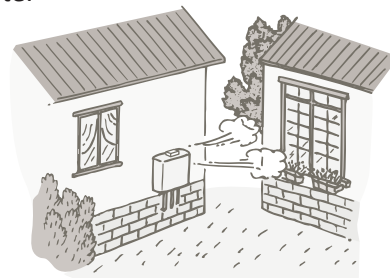
Prohibited



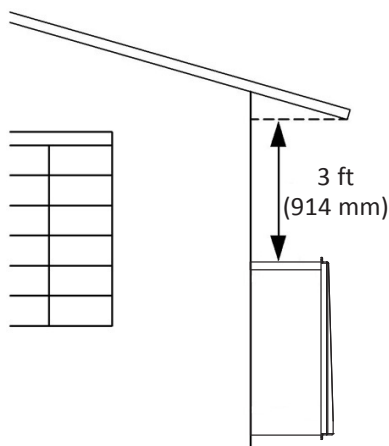
Do not have the vent terminal pointing toward any opening into a building. Do not locate your heater in a pit or location where gas and water can accumulate.



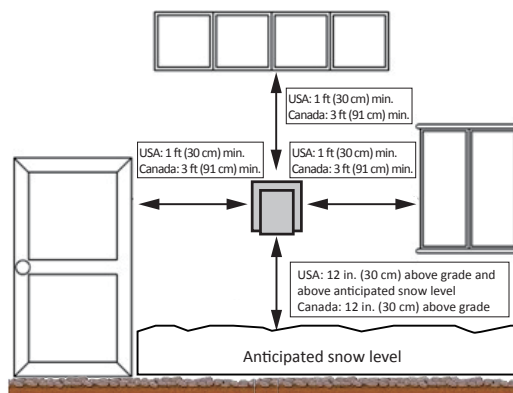
Prohibited



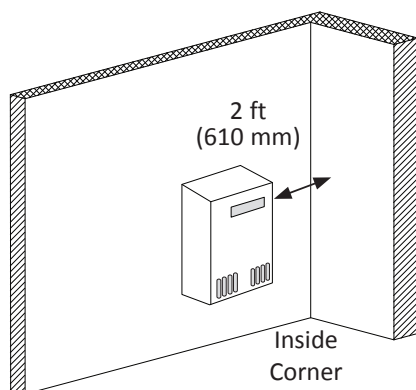
Do not install this water heater under an overhang less than 3 ft (914 mm) from its top or eaves. The area under an overhang must be open to three sides (Outdoor model only).



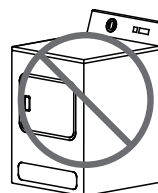
Ensure that you meet the minimum clearances shown below for a direct vent termination:



Water heater vent terminator must be at least 2 ft (610 mm) away from an inside corner for both outdoor installation and direct-vent installation.



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.



HIGH-ALTITUDE INSTALLATIONS



WARNING

- Adjust the appropriate DIP switches according to model and elevation as shown below. **DO NOT** adjust the other DIP switches.
- Turn off the power supply to the water heater before changing the DIP switch settings.
- Failure to observe these warnings could lead to carbon monoxide poisoning or death.

Check the elevation where your water heater is installed. Set DIP switches shown in the table below depending on the altitude.

Indoor model

Altitude	0 to 2,000 ft (0 to 610 m) (DEFAULT)	2,000 to 3,000 ft (611 to 914 m)	3,000 to 5,000 ft (915 to 1,524 m)	5,000 to 7,500 ft (1,525 to 2,286 m)	7,500 to 10,100 ft (2,287 to 3,078 m)
DIP switches					
	No. 3 : OFF No. 4 : OFF No. 5 : OFF	No. 3 : OFF No. 4 : ON No. 5 : OFF	No. 3 : OFF No. 4 : OFF No. 5 : ON	No. 3 : OFF No. 4 : ON No. 5 : ON	No. 3 : ON No. 4 : ON No. 5 : ON

Outdoor model

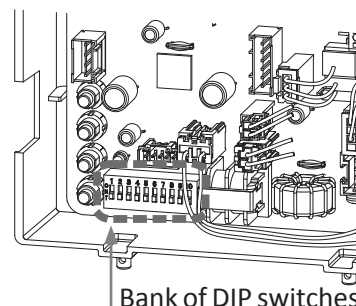
Altitude	0 to 2,000 ft (0 to 610 m) (DEFAULT)	2,000 to 4,000 ft (611 to 1,219 m)	4,000 to 6,000 ft (1,220 to 1,829 m)
DIP switches			
	No. 3 : OFF No. 4 : OFF No. 5 : OFF	No. 3 : OFF No. 4 : OFF No. 5 : ON	No. 3 : ON No. 4 : OFF No. 5 : ON

Installation altitude

The maximum certified or allowable installed altitude is 10,100 ft (3,078 m) for indoor models and 6,000 ft (1,829 m) for outdoor models.

NOTE: The dark squares indicate the correct DIP switch positions.

Computer board



VENTING INSTRUCTIONS

Indoor model **-General-**



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. Improper installation will void product warranty.
- 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.

The Indoor model must be vented in accordance with "Venting of Equipment" in the current edition of the National Fuel Gas Code: ANSI Z223.1/NFPA 54 in the United States and/or Section 8 of the B149.1 Natural Gas and Propane Installation Code in Canada, as well as applicable local building codes.

The use of venting materials approved for Category III/IV appliances is recommended whenever possible. However, the Indoor model may also be vented with plastic pipe materials such as ABS, PVC (solid core), CPVC (solid core), or polypropylene. **For details, please refer to the Exhaust Vent (ABS, PVC, CPVC, or Polypropylene Vent) Section on p. 18.** Vent installations in Canada which utilize plastic vent systems must use venting that complies with ULC S636.

General rules for venting water heaters:

- Place the water heater as close as possible to the vent termination.
- The vent collar of the water heater must be fastened directly to an unobstructed vent pipe.
- Do not weld 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.
- The water heater vent must not be connected to any other gas appliance or vent stack.
- Avoid using an oversized vent pipe or using extremely long runs of the pipe unless it is part of an approved common vent system.
- Air supply pipe can be made of ABS, PVC (solid core), CPVC (solid core), polypropylene, corrugated stainless steel, or Category III / IV stainless steel. Regarding exhaust pipe, refer to pp.18 to 24.
- Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenylsulfone) in nonmetallic venting systems is prohibited. Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.
- Sidewall venting is recommended for the Indoor model. Vertical venting (roof termination) is acceptable.
- The manufacturer recommends running the exhaust vent and the intake pipe as parallel as possible.
- For rooftop venting, a rain cap or other form of termination that prevents rain water from entering into the water heater must be installed.
- Do not terminate vent into a chimney. If the vent must go through the chimney, the vent must run all the way through the chimney with approved vent pipe.
- 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 in (305 mm) 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.
- A proper sidewall termination is recommended when the water heater is vented through a sidewall.
- Regarding the clearances from the exhaust termination to the air inlet or opening, refer to pp. 25 to 27.

-Combustion air supply-



WARNING

This gas water heater requires an adequate source of clean air for combustion and ventilation. Without sufficient air, your water heater may not operate properly and may emit excessive and abnormal amounts of carbon monoxide which may result in carbon monoxide poisoning or death.

NOTICE

- **The guidelines in this section apply to installations within the United States. All U.S. installations must conform to the National Fuel Gas Code, ANSI Z223.1/NFPA 54 (current edition) and local codes.**
- **Canadian requirements differ from the guidelines in this section. In Canada, follow the requirements of B149.1 (Natural Gas and Propane Installation Code, current edition) as well as local and provincial codes. Contact your local code enforcement agency for direction.**

Before installing the water heater, you must determine the amount of air needed to supply this water heater and any other gas appliances in the same area and provide adequate air for combustion and ventilation. Consult a qualified person if you're unsure of the proper way to supply air to your water heater.

Check for Chemicals:

Air for combustion and ventilation must be clean and free of corrosive chemicals. If corrosive chemicals, such as sulfur, fluorine, or chlorine are present, the water heater must be direct vented. Failure due to these corrosive chemicals is not covered by the warranty.

WARNING!

In all cases, ensure that corrosive chemicals are not present at the air intake. Presence of such chemicals at the air intake could result in death, personal injury, or property damage. Examples of locations that require outside air due to chemicals include:

- Beauty salons
- Photo processing labs
- Indoor pools
- Laundry, hobby, or craft rooms
- Chemical storage areas

Products such as aerosol sprays, detergents, bleaches, cleaning solvents, gasoline, air fresheners, paint and varnish removers, and refrigerants should not be stored or used near the water heater.

Does your installation space have sufficient combustion air?

Ventilation with outside air is recommended for all installations. Even if the water heater is installed in a large, open room inside the house, outdoor air is usually needed because modern homes are very tightly sealed and often do not supply enough air to the water heater. However, when installed in a large indoor space, it may be possible to provide enough air without outside ventilation. If you are unsure if your installation location has enough ventilation, contact your local gas utility company or code officials for a safety inspection or direct vent the water heater.

The following instructions will help determine if it may be possible to install the water heater without outside ventilation.

Calculate total BTU/h rating of all appliances.

To calculate the combustion air and ventilation required, add up the total BTU/h ratings of all gas burning appliances (e.g., water heaters, furnaces, clothes dryers) in the same area. Do not include appliances that are direct vented. Refer to the following example.

Your water heater's BTU/h rating is on the rating plate. The BTU/h ratings should be on the other appliances' rating plates. If you have trouble determining the BTU/h ratings, contact the manufacturer or have a qualified person determine the ventilation requirements.

NOTICE: If you are replacing your old water heater with one that has a higher BTU/h rating, the amount of ventilation required may be greater.

Example:

Gas Burning Appliance	BTU/h Rating
Gas Water Heater	120,000
Furnace	75,000
Dryer	20,000
Total	215,000

Your appliances:

Gas Burning Appliance	BTU/h Rating
Gas Water Heater	
Total	

Calculate the air volume of the room

Air requirements depend on the size of the room.

$$\text{Room Volume (ft}^3\text{)} = \text{Floor Area (ft}^2\text{)} \times \text{Ceiling Height (ft)}$$

If there are large objects in the room (e.g., refrigerator, furnace, car), subtract their volume from the volume of the room to get a better estimate of the air available.

$$\text{Air Volume} = \text{Room Volume} - \text{Object Volume}$$

NOTE: Adjoining rooms with permanently opened doorways can be counted as part of the calculation.

Calculate required air volume

A water heater installed in an unconfined attic, garage, or space requires that the space be at least 50 ft³ (1.42 m³) per 1,000 BTU/h of the total input for all gas burning appliances in the same area.

$$\text{Required Air Volume (ft}^3\text{)} = \text{Total Appliance Energy Rating (btu/h)} \times 50 \text{ ft}^3 / 1000 \text{ (btu/h)}$$

Example:

$$(215,000 / 1000) \times 50 = 10,750 \text{ ft}^3$$

If the air volume of the room is less than the required air volume, you must direct vent the water heater or provide permanent outside air openings that draw in sufficient air. Go to "Install with outside ventilation" if you want to provide combustion air with outside ventilation.

If the air volume of the room is greater than the required air volume, it may be possible to install the water heater without outside ventilation. However, be sure to consider the effects of exhaust fans. Exhaust fans can affect the amount of combustion air that is available in your home. Appliances such as furnaces, whole house fans, and clothes dryers draw air out of your home. If they draw air out faster than it can be replaced, your water heater may not have enough oxygen to fire properly. Back-drafting may also result, which is when negative air pressure pulls air backwards through chimneys or appliance vents. These events can cause unsatisfactory water heater performance. The best solution is to direct vent the water heater or install an adequate number of make-up air vents. (See "Install with outside ventilation".) For more information, consult a qualified technician or your local gas utility.

Install with outside ventilation

Ventilation with outside air is recommended, and, for most installations, is needed. There may be existing ventilation that is adequate, or you may need to add more ventilation.

Supplying outside air to the water heater typically requires two openings. One opening must be within 12 in (305 mm) from the floor and the second opening must be within 12 in (305 mm) from the ceiling. Although a single opening is not preferred, you may use a single opening to outside air if the minimum free area is sized according to **Table 1**. Two openings must be used when ventilating with air from another room.

The outside air can be taken from a crawl space or attic open to the outdoors and adequately ventilated. You may use vertical or horizontal ducts.

Determine type of ventilation

There are several types of ventilation that can be used. The various options are listed below. See also the illustrations on the next page.

1. Direct to outdoors
2. Vertical ducts
3. Horizontal ducts
4. Single opening (not recommended; must be at least 100 in² (6.5 cm²) . Not appropriate for confined spaces smaller than 50 ft³ (1.42 m³) per 1,000 BTU/h or when getting air from another room.)
5. From a larger room inside the house (not recommended – refer to "Calculate the air volume of the room" above to determine if the combined volume of the rooms may be adequate).

Determine minimum free area required for each vent opening

The size of the vent openings depends on the total BTU/h rating of all appliances in the space (use your calculation from "Before beginning") and the type of vent used. **Table 1** provides the minimum free area for each vent opening depending on the type of ventilation.

Calculate minimum size of vent openings and ducts

The vent cross-sectional area needed to provide the free area depends on the covering on the vent openings. Typical vents use louvers or grilles to protect the opening. The louver or grill itself blocks some of the free area, so the opening may need to be larger to meet the minimum free area requirements.

Use the following formula to calculate the required cross-sectional area:

Cross-sectional area = minimum free area required ÷ percent free area of covering (in decimals – e.g., 60 % = 0.6)

For example, an installation area that requires openings with 100 in² (645 cm²) of free area would need 134 in² (865 cm²) openings if using metal louvers rated at 75% free area (100 in² ÷ 0.75 = 134 in²).

If you do not know the % free area for your louver or grill, use the following values:

- For wood louvers or grilles: 25%
- For metal louvers or grilles: 75%

Follow these rules to ensure that vents and ducts provide adequate air flow:

- Each vent opening must be no smaller than 100 in² (645 cm²).
- Ducts must have the same cross-sectional area as free area of the opening.
- Rectangular ducts must have a minimum dimension of no less than 3 in (76 mm).
- All screens must have mesh ¼" or larger.
- Moveable louvers must be locked open or interconnected with the equipment so that they open automatically during operation.
- Keep louvers and grills clean and free of debris or other obstructions.

Check that air source is clean and free of chemicals

Air for combustion and ventilation must be clean and free of corrosive or flammable chemicals. A failure due to corrosive chemicals in the air is not covered by the warranty. Combustion air must be free of acid-forming chemicals such as sulfur, fluorine, and chlorine. Be sure that air at the vent inlets is free of such chemicals.

Table 1 Minimum Free Area of Permanent Openings for Ventilation and Combustion Air Supply – Air from outdoor or indoor spaces. Based on the total BTU/h input rating for all gas burning appliances within a confined space.	
Opening Source	Minimum Free Area
Direct to outdoors*	1 in ² (6.5 cm ²) per 4,000 BTU/hr (see Figure 1, 2)
Vertical ducts	1 in ² (6.5 cm ²) per 4,000 BTU/hr (see Figure 3)
Horizontal ducts	1 in ² (6.5 cm ²) per 2,000 BTU/hr (see Figure 4)
Single Opening	1 in ² (6.5 cm ²) per 3,000 BTU/hr (see Figure 5)
Two permanent openings to another room**	1 in ² (6.5 cm ²) per 1,000 Btu/hr (see Figure 6) Opening: 100 in ² (645 cm ²) Min Minimum dimension of air openings: no less than 3 in (76 mm)
*These openings connect directly with the outdoors through a ventilated attic, a ventilated crawl space, or through an outside wall.	
**United States: For direction on combining spaces in different stories within the structure, refer to the current edition of the National Fuel Gas Code ANSI Z223.1/NFPA 54. In Canada, contact your local code enforcement agency for direction.	

See graphics on next page.

Combustion air supply options

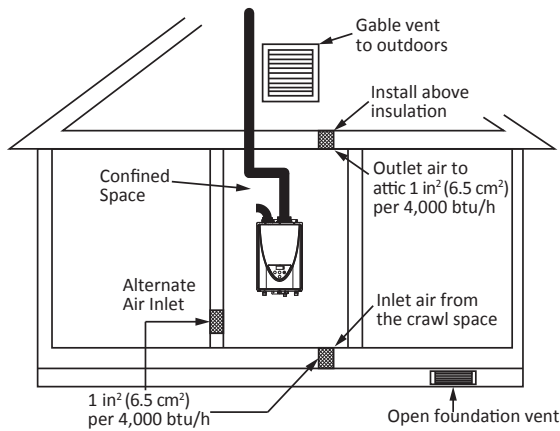


Figure 1 - Direct to outdoors openings

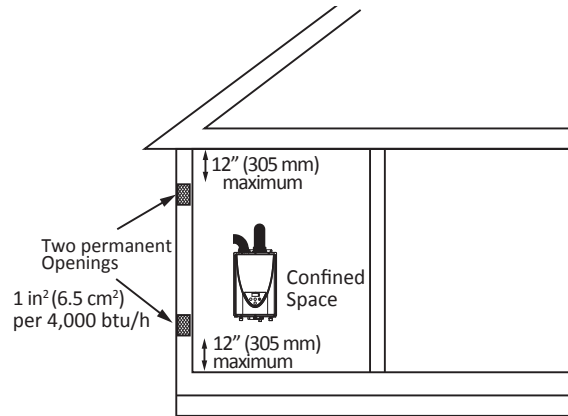


Figure 2 - Direct to outdoors openings
Two permanent openings

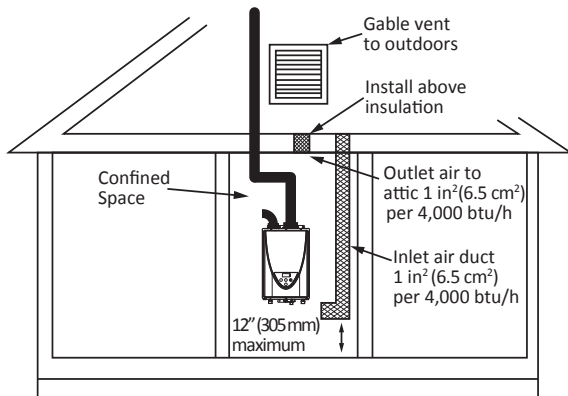


Figure 3 - Vertical duct openings

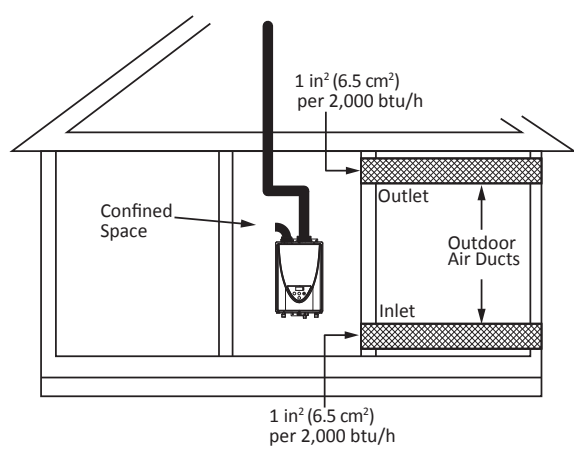


Figure 4 - Horizontal duct openings

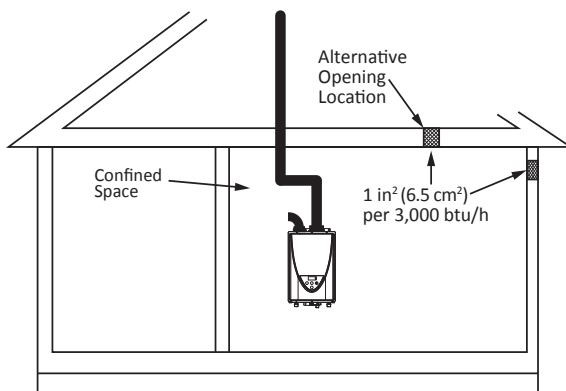


Figure 5 - Single opening

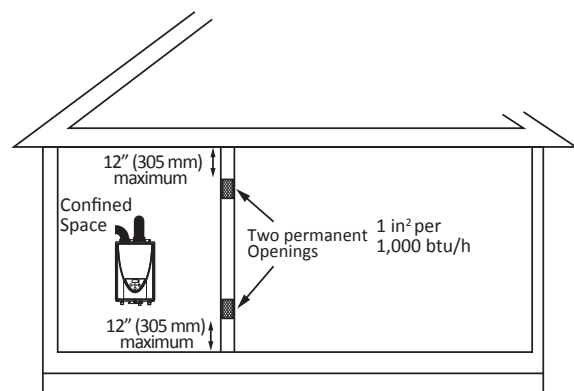


Figure 6 - Two permanent openings

-Exhaust vent (ABS, PVC, CPVC, or polypropylene vent)-

The Indoor model can be vented with ABS, PVC, CPVC, or polypropylene (temperature rated up to at least 149 °F). Vent material certified to ULC S636 standards is recommended in the USA. In Canada, plastic venting must be certified to ULC S636 standards.

Item	Material	United States	Canada
Exhaust pipe and Fittings	Schedule 40 PVC	ANSI/ASTM D1785	ULC S636 Certified Materials Only
	PVC-DWV	ANSI/ASTM D2665	
	Schedule 40 CPVC	ANSI/ASTM F441	
	Schedule 40 ABS-DWV	ANSI/ASTM D2661	
	Polypropylene	UL-1738	
Pipe Cement/Primer	PVC	ANSI/ASTM D2564	
	CPVC	ANSI/ASTM F493	
	ABS	ANSI/ASTM D2235	
Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenylsulfone) in non-metallic venting systems is prohibited. Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.			

- The maximum length of exhaust vent piping must not exceed 70 ft (21.3 m) for 3 inch venting, which depends on the elevation where the water heater is installed, and 100 ft (30.5 m) for 4 inch venting (deducting 5 ft (1.5 m) for each elbow used in the venting system). Do not use more than 5 elbows. See the table below.
- When the horizontal vent run exceeds 5 ft (1.5 m), support the vent run at 3 ft (0.9 m) intervals with overhead hangers.

Vertical or Horizontal (Total) Vent Length					
No. of Elbows*	2" venting	3" venting			4" venting
	0 to 3,000 ft (0 to 914 m)	0 to 3,000 ft (0 to 914 m)	3,001 to 6,000 ft (915 to 1,829 m)	6,001 to 10,100 ft (1,830 to 3,078 m)	0 to 10,100 ft (0 to 3,078 m)
0	6.5 ft (2.0 m)	70 ft (21.3 m)	40 ft (12.2 m)	25 ft (7.6 m)	100 ft (30.5 m)
1	1.5 ft (0.5 m)	65 ft (19.8 m)	35 ft (10.7 m)	20 ft (6.1 m)	95 ft (29.0 m)
2	N/A	60 ft (18.3 m)	30 ft (9.1 m)	15 ft (4.6 m)	90 ft (27.4 m)
3	N/A	55 ft (16.8 m)	25 ft (7.6 m)	10 ft (3.0 m)	85 ft (25.9 m)
4	N/A	50 ft (15.2 m)	20 ft (6.1 m)	N/A	80 ft (24.4 m)
5	N/A	45 ft (13.7 m)	N/A	N/A	75 ft (22.9 m)

Excludes vent terminators, one termination elbow, or rain caps.

For details on the vent connection, refer to pp. 19 to 22.

***For each elbow added, deduct 5 ft (1.5 m) from max. vent length.**

-DIP switch settings for vent length-

Typical installations using PVC, CPVC, ABS, or polypropylene vent



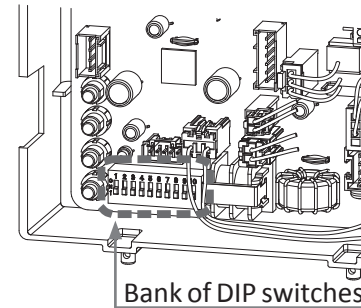
WARNING

- Adjust the appropriate DIP switches according to vent size and vent length as shown below. **DO NOT** adjust the other DIP switches.
- Turn off the power supply to the water heater before changing the DIP switch settings.
- Failure to observe these warnings could lead to carbon monoxide poisoning or death.

2 inch vent installation

Vent length	Single vent
5 to 6.5 ft (1.5 to 2.0 m)	No. 6 : ON No. 7 : ON

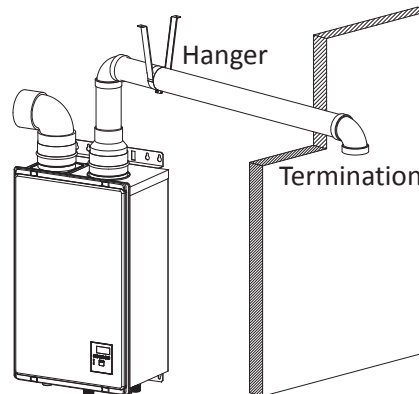
Computer board



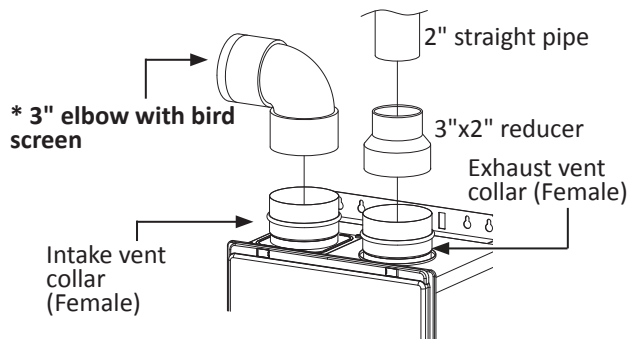
Bank of DIP switches

Single vent with room-air intake

- For details of the optional items, refer to the Installation manual for each optional item.
- For clearance information, refer to pp. 25 to 27.



Vent connections for single vent



1. Connect a 3" elbow directly on the intake vent collar of the water heater.
2. Connect a 3" x 2" reducer directly on the exhaust vent collar of the water heater. Make sure the couplings engage the o-rings installed in the intake and exhaust vent collars
3. Connect a 2" straight pipe to the reducer.

*The bird screen that fits into the 3 inch elbow is supplied with the indoor water heater.



WARNING

- Adjust the appropriate DIP switches according to vent size and vent length as shown below. **DO NOT** adjust the other DIP switches.
- Turn off the power supply to the water heater before changing the DIP switch settings.
- Failure to observe these warnings could lead to carbon monoxide poisoning or death.

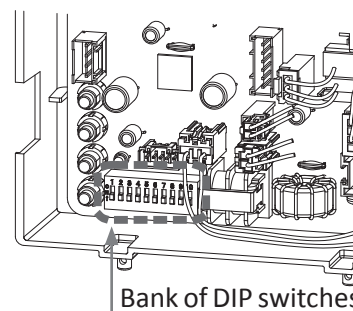
3 inch vent installation

Vent length	Direct vent	Vent length	Single vent
5 to 20 ft (1.5 to 6.0 m) (DEFAULT)	ON 1 2 3 4 5 6 7 8 9 10 OFF  No. 6 : ON No. 7 : OFF	5 to 45 ft (1.5 to 13.7 m) (DEFAULT)	ON 1 2 3 4 5 6 7 8 9 10 OFF  No. 6 : ON No. 7 : OFF
21 to 40 ft (6.1 to 12.2 m)	ON 1 2 3 4 5 6 7 8 9 10 OFF  No. 6 : OFF No. 7 : OFF	46 to 70 ft (13.8 to 21.3 m)	ON 1 2 3 4 5 6 7 8 9 10 OFF  No. 6 : OFF No. 7 : OFF
41 to 70 ft (12.3 to 21.3 m)	ON 1 2 3 4 5 6 7 8 9 10 OFF  No. 6 : ON No. 7 : ON		

4 inch vent installation

Vent length	Direct vent and Single vent
5 to 50 ft (1.5 to 15.2 m) (DEFAULT)	ON OFF No. 6 : ON No. 7 : OFF
51 to 100 ft (15.3 to 30.5 m)	ON OFF No. 6 : OFF No. 7 : OFF

Computer board



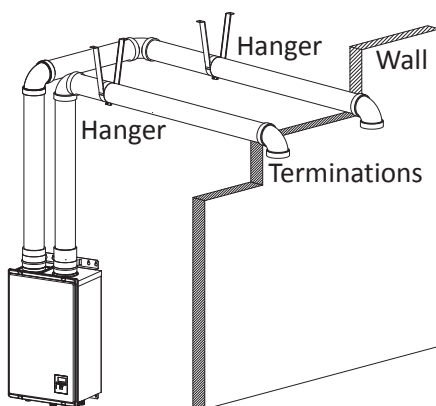
Bank of DIP switches

Examples of installation of 3 inch & 4 inch vent

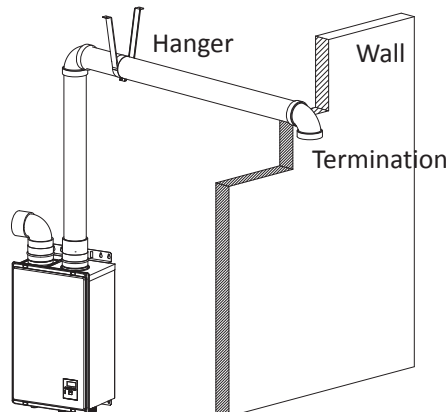
- For details of the optional items, refer to the Installation manual for each optional item.
- For clearance information, refer to pp. pp. 25 to 27.

Horizontal installation

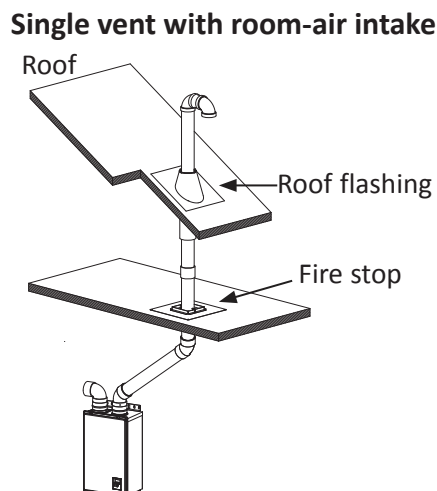
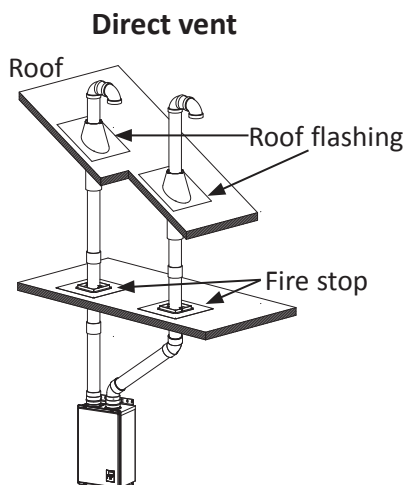
Direct vent



Single vent with room-air intake

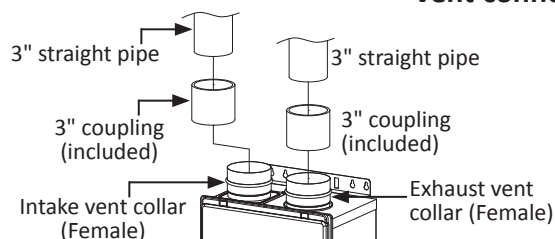


Vertical installation



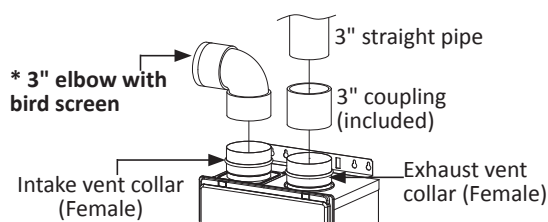
3 inch vent installation

Vent connections for direct vent



1. Connect 3" couplings directly on the exhaust and intake vent collar of the water heater. Make sure the couplings engage the o-rings installed in the intake and exhaust vent collars.
2. Connect 3" straight pipes to the couplings.

Vent connections for single vent

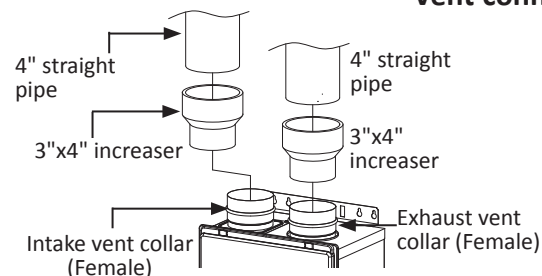


1. Connect a 3" elbow directly on the intake vent collar of the water heater.
2. Connect a 3" coupling directly on the exhaust vent collar of the water heater. Make sure the couplings engage the o-rings installed in the intake and exhaust vent collars.
3. Connect a 3" straight pipe to the coupling.

*The bird screen that fits into the 3 inch elbow is supplied with the indoor water heater.

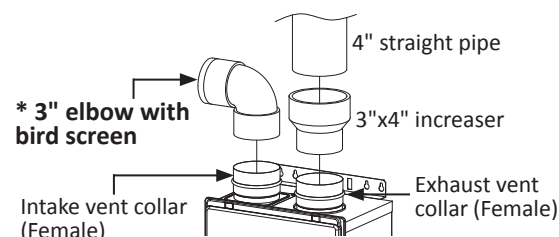
4 inch vent installation

Vent connections for direct vent



1. Connect 3"x4" increasers directly on the exhaust and intake vent collar of the water heater. Make sure the couplings engage the o-rings installed in the intake and exhaust vent collars.
2. Connect 4" straight pipes to the increasers.

Vent connections for single vent



1. Connect a 3" elbow directly on the intake vent collar of the water heater.
2. Connect a 3"x4" increaser directly on the exhaust vent collar of the water heater. Make sure the couplings engage the o-rings installed in the intake and exhaust vent collars.
3. Connect a 4" straight pipe to the increaser.

*The bird screen that fits into the 3 inch elbow is supplied with the indoor water heater.

CENTROTHERM PP VENTING (Polypropylene)

WARNING! Do not mix parts or fittings of different material types, and do not mix pipe, fittings, or joining methods from different manufacturers. Combustion exhaust can contain carbon monoxide and must be properly vented outside. Breathing abnormal amounts of carbon monoxide can result in serious injury or death.

Description	Centrotherm Part Number (Trade Name InnoFlue)
4"/6" (102 mm/152 mm) x 39" (990 mm) Concentric Wall	ICWS4639
4" (102 mm) Twin Pipe to 4"/6" (102 mm/152 mm) Concentric Adaptor	ICTC0446
4" (102 mm) x 87° Elbow	ISEL0487
100 mm to 4" (102mm) Increaser	ISIA10004
4" (102 mm) x 12" (305 mm) Vent Length	ISVL041
4" (102 mm) x 24" (610 mm) Vent Length	ISVL042
4" (102 mm) x 36" (914 mm) Vent Length	ISVL043
4" (102 mm)x 72" (1,829 mm) Vent Length	ISVL046
4" (102 mm) Horizontal Drain Tee	ISHDT04
3"/5" (76 mm/127 mm) x 13" (330 mm) Concentric Wall Termination SS	ICWS3513
3" (76 mm) Twin Pipe to 3"/5" (76 mm/127 mm) Concentric Adaptor	ICTC0335
3" (76 mm) x 87 Elbow	ISEL0387
3" (76 mm) x 12" (305 mm) Vent Length	ISVL031
3" (76 mm) x 24" (610 mm) Vent Length	ISVL032
3" (76 mm) x 36" (914 mm) Vent Length	ISVL033
3" (76 mm) x 72" (1,829 mm) Vent Length	ISVL036
100 mm to 4" (102 mm) Increaser	ISIA10004
100 mm to 4" (102 mm) 110 mm	ISRA1003
3" (76 mm) Horizontal Drain Tee	ISHDT03

-Exhaust vent (Stainless steel vent)-

This is a Category IV appliance and must be vented accordingly. The vent system must be sealed airtight. All seams and joints **without gaskets** must be sealed with high heat resistant silicone sealant or UL listed aluminum adhesive tape having a minimum temperature rating of 160 °F. For best results, a vent system should be as short and straight as possible.

- The Indoor model is a Category IV appliance and must be vented accordingly with any 4 inch vent approved for use with Category III/IV or Special BH type gas vent.
- The manufacturer recommends the NovaVent (Z-Vent) line.** However, the following are also UL listed manufacturers: ProTech Systems Inc. (FasNSeal), Metal-Fab Inc., and Heat-Fab Inc. (Saf-T Vent).
- Follow the vent pipe manufacturer's instructions when installing the vent pipe.**
- The maximum length of exhaust vent piping must not exceed 100 ft (30.5 m) (deducting 5 ft (1.5 m) for each elbow used in the venting system). Do not use more than 5 elbows.
- When the horizontal vent run exceeds 5 ft (1.5 m), support the vent run at 3 ft (0.9 m) intervals with overhead hangers.

Diameter	Max. No. of Elbows	Max. Vertical and Horizontal (Total) Vent Length
4 in. (102 mm)	5	100 ft (30.5 m)

***For each elbow added, deduct 5 ft (1.5 m) from max. vent length.**

No. of Elbows	Max. Vertical or Horizontal Vent Length	No. of Elbows	Max. Vertical or Horizontal Vent Length
0	100 ft (30.5 m)	3	85 ft (25.9 m)
1	95 ft (29.0 m)	4	80 ft (24.4 m)
2	90 ft (27.4 m)	5	75 ft (22.9 m)

Excludes vent terminators, termination elbows, or rain caps.

-DIP switch settings for vent length- Typical installations using stainless steel vents



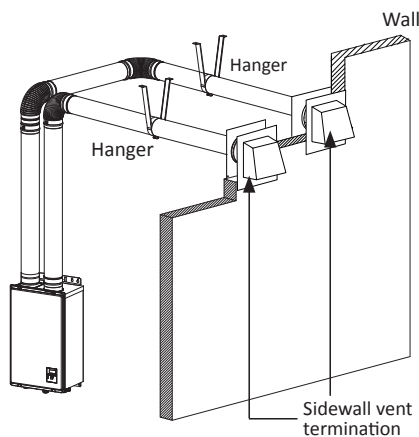
WARNING

- Adjust the appropriate DIP switches according to size and vent length as shown below. **DO NOT** adjust the other DIP switches.
- Turn off the power supply to the water heater before changing the DIP switch settings.
- Failure to observe these warnings could lead to carbon monoxide poisoning or death.

4 inch vent installation

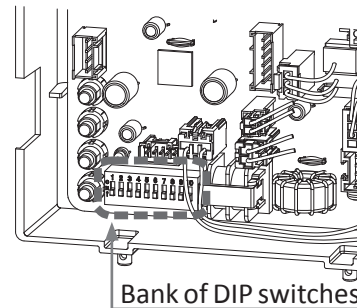
Vent length	Two-pipe and Single pipe
5 to 50 ft (1.5 to 15.2 m) (DEFAULT)	No. 6 : ON No. 7 : OFF
51 to 100 ft (15.3 to 30.5 m)	No. 6 : OFF No. 7 : OFF

Horizontal Installation

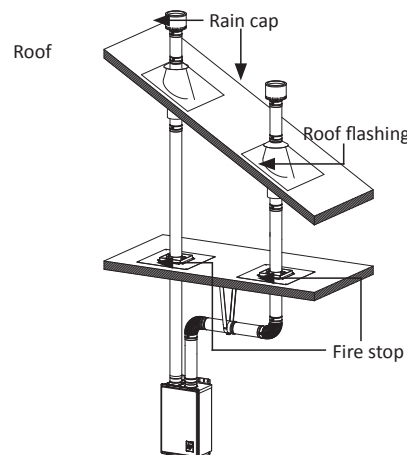


For details of the optional items, refer to the Installation manual for each optional item.

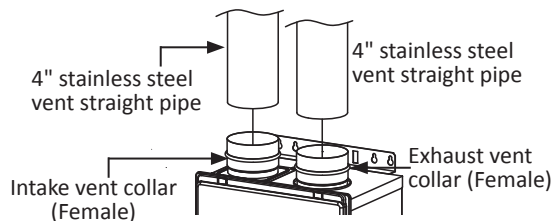
Computer board



Vertical Installation

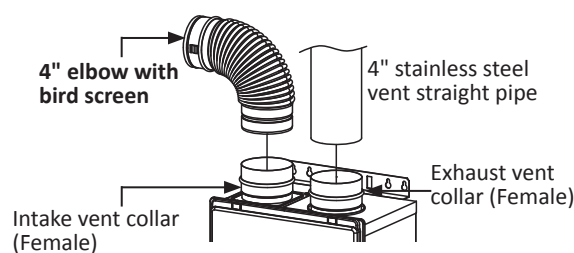


Vent connections for direct vent



Connect 4" stainless steel ventstraight pipes directly on the exhaust/intake vent collar of the water heater.

Vent connections for single vent



1. Connect a 4" stainless steel vent straight pipes directly on the exhaust vent collar of the water heater.
2. Connect a 4" elbow directly on the intake vent collar of the water heater.

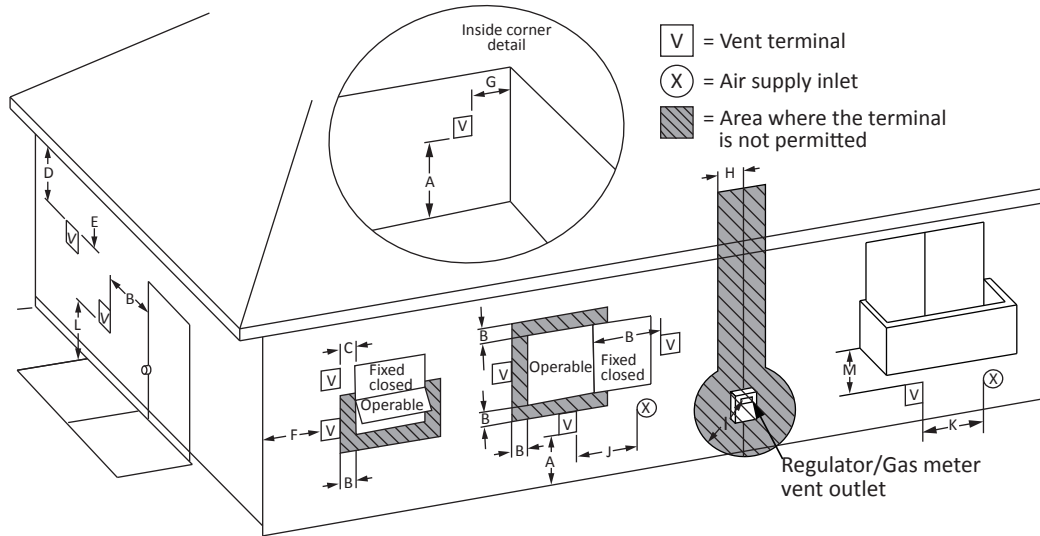


WARNING

- See pp. 25 to 27 regarding clearances from the exhaust terminal to the air inlet or opening.
- Follow all vent system manufacturer's instructions and all local codes.
- Use 4" (102 mm) Category III/IV approved or Special BH, single or double wall stainless steel vent pipe.
- **Do not mix parts or fittings of different material types, and do not mix pipe, fittings, or joining methods from different manufacturers. Combustion exhaust can contain carbon monoxide and must be properly vented outside. Breathing abnormal amounts of carbon monoxide can result in serious injury or death.**

Approved Category IV, Single Wall, Venting Suppliers and Part Numbers							
Description	Heater Vent Kits	Z-FLEX®		Description	Heater Vent Kits	Z-FLEX®	
		Nova VENT™	Z-VENT™			Nova VENT™	Z-VENT™
4" (102 mm) Straight pipe - 6" (152 mm) length	100112407	2NVP4.5	2SVEPWCF0406	4" (102 mm) 3-in-1 adaptor (F-F adaptor, condensate drain, & back-flow preventer)	100112585	2NVBFA4	2SVBFDPA04
4" (102 mm) Straight pipe - 12" (305 mm) length	100112406	2NVP41	2SVEPWCF0401	4" (102 mm) F-F adaptor	100112399	2NVAFF4	2SVEEWCF0445
4" (102 mm) Straight pipe - 24" (610 mm) length	100112404	2NVP42	2SVEPWCF0402	4" (102 mm) Backflow preventer w/ F-F adaptor	100112416	2NVBFU4	2ZVB04
4" (102 mm) Straight pipe - 36" (914 mm) length	100112403	2NVP43	2SVEPWCF0403	4" (102 mm) exhaust / 3" (76 mm) intake DV concentric termination - 5"-10" (127 - 254 mm) adjustability	100112550	2NVHTC43S	2SVSHTC43S
4" (102 mm) Straight pipe - 48" (1,219 mm) length	100112402	2NVP44	2SVEPWCF0404	4" (102 mm) exhaust / 3" (76 mm) intake DV concentric termination - 12"-18" (305 - 457 mm) adjustability	100112551	2NVHTC43	2SVSHTC43
4" (102 mm) Adjustable straight pipe - 10"-18" (254 - 457 mm) adjustability	100112405	2NVAL4	2SVSPA04	4" (102 mm) Sidewall termination, adjustable pipe	100187853	2NVBV4	n/a
4" (102 mm) 45 degree elbow	100112401	2NVE445	2SVEEWCF0445	4" (102 mm) Wall Thimble, 3"-6" (76 - 152 mm) wall thickness	100187852	2NVBT4	n/a
4" (102 mm) 90 degree elbow	100112400	2NVE490	2SVEEWCF0490	4" (102 mm) exhaust / 3" (76 mm) intake concentric termination - 5" to 10" (127 - 254 mm) adjustability	100112550	2NVHTC43S	2SVSHTC43S
4" (102 mm) Sidewall termination (4" (102 mm) Termination Hood)	100112419	2NVTH4	2SVSHTX04	4" (102 mm) exhaust / 3" (76 mm) intake concentric termination - 12" to 18" (305 - 457 mm) adjustability	100112551	2NVHTC43	2SVSHTC43
4" (102 mm) Vent termination tee	100112547	2NVTT4	2SVSTTF04	4" (102 mm) exhaust / 4" (102 mm) intake concentric termination - 5" to 10" (127 - 254 mm) adjustability	100112552	2NVHTC44S	2SVSHTC04S
4" (102 mm) Rain Cap	100112415	2NVRC4	2SVSRCF04	4" (102 mm) exhaust / 4" (102 mm) intake concentric termination - 12" to 18" (305 - 457 mm) adjustability	100112553	2NVHTC44S	2SVSHTC04
4" (102 mm) Extreme weather rain cap	100112548	2NVWC4	2SVSHRC04	4" (102 mm) Flat roof flashing	100112412	2NVFF4	2SVSSCF04
4" (102 mm) Horizontal drain tee	100112414	2NVHD4	2SVEDWCF04	4" (102 mm) Angled roof flashing	100112411	2NVAF4	2SVSADJF04
4" (102 mm) Vertical drain tee	100112413	2NVVD4	2SVEVDP04	Storm collar	100112410	2NVSC4	2SVSLSF04
4" (102 mm) wall thimble length 4"-7" (102 - 178 mm) wall thickness	100112732	2NVWT4	2SVSWTF04	Wall support	100112409	2NVSS41	2SVSWS04
4" (102 mm) wall thimble length 5"-10" (127 - 254 mm) wall thickness	100112733	2NVWT4L	2SVSWTEF04	Firestop support	100112408	2NVFS4	2SVSFSSF04

-Vent termination clearances-



		Canada Installations ¹	US Installations ²	
		Direct vent and other than direct vent	Direct vent	Other than direct vent
A	Clearance above grade, veranda, porch, deck, or balcony	1 ft (30 cm)	1 ft (30 cm)	
B	Clearance to window or door that may be opened	3 ft (91 cm)	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	0	0
D	Vertical clearance to ventilated soffit located above the vent terminator within a horizontal distance of 2 feet (61cm) from the center line of the termination	3 ft (91 cm)	3 ft (91 cm)	3 ft (91 cm)
E	Clearance to unventilated soffit	3 ft (91 cm)	3 ft (91 cm)	3 ft (91 cm)
F	Clearance to outside corner	2 ft (61 cm)	2 ft (61 cm)	2 ft (61 cm)
G	Clearance to inside corner	2 ft (61 cm)	2 ft (61 cm)	2 ft (61 cm)
H	Clearance to each side of center line extended above meter/regulator assembly	3 ft (91 cm)	*	*
I	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*	*
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance.	3 ft (91 cm)	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	6 ft (183 cm)	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)**	7 ft (213 cm)	7 ft (213 cm)
M	Clearance under veranda, porch deck, or balcony	1 ft (30 cm)***	1 ft (30 cm)***	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.

The vent for condensing water heaters shall not terminate:

- 1) over public walkways; or
- 2) near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage; or
- 3) where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Notes:

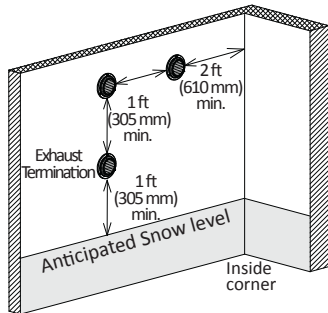
1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

-Clearances for sidewall terminations-

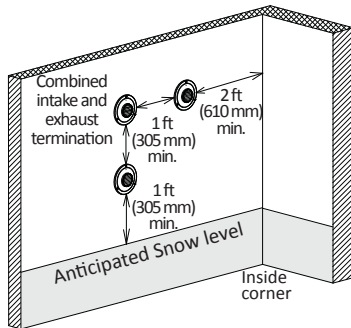
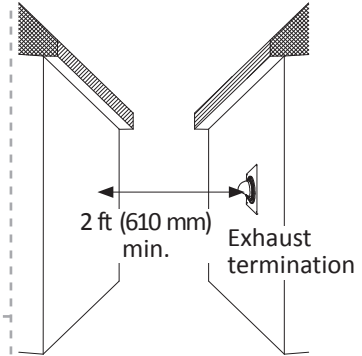


Improper installation can result in carbon monoxide poisoning or death. Follow all local and national codes in regards to proper termination clearances. In the absence of such codes, the clearances below can be used as guidelines. Local codes supersede these guidelines.



Multiple Sidewall Terminations

An exhaust termination must be at least 1 ft (305mm) away from another exhaust termination. An exhaust termination must also be at least 2 ft (610 mm) away from an inside corner. (If the adjacent wall is less than 2 ft (610 mm) of length, the minimum required distance away from the inside corner will be equal to the length of that adjacent wall.)



Multiple DV Sidewall Terminations

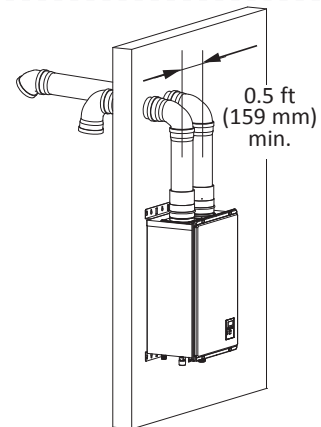
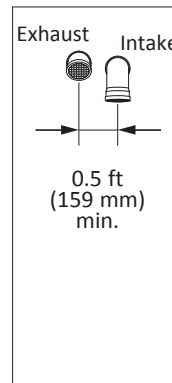
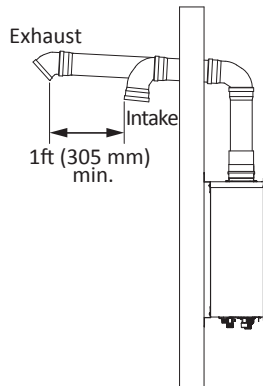
A direct vent (DV) termination must be at least 1 ft (305 mm) away from other direct vent terminations.

A direct vent termination must also be at least 2 ft (610 mm) away from an inside corner. (If the adjacent wall is less than 2 ft (610 mm) of length, the minimum required distance away from the inside corner will be equal to the length of that adjacent wall.)

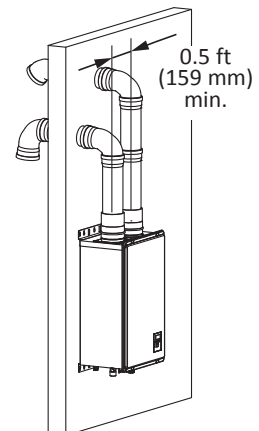
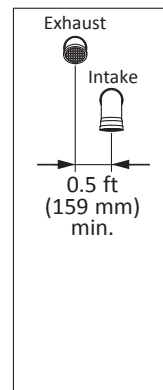
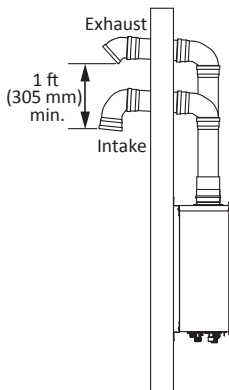
Exhaust and/or direct vent sidewall terminations should be at least 2 ft (610 mm) away from an opposite surface/wall. Do not place the termination directly in front of an opening into a building.

<Case 1>

For direct vent sidewall terminations that use two separate penetrations for the intake and exhaust, keep the termination clearances shown in the diagrams on the right. The installation is for only 3 inch and 4 inch vent installations only.



<Case 2>



-Clearances for rooftop terminations-



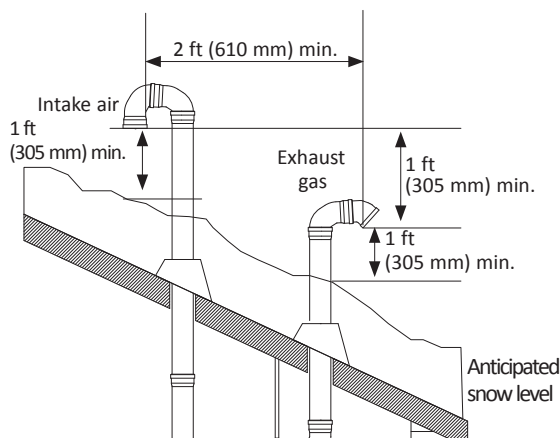
WARNING

Follow all local and national codes in regards to proper termination clearances. In the absence of such codes, the clearances below must be met. Local codes supersede these clearances. Failure to observe this warning may result in severe personal injury or death.

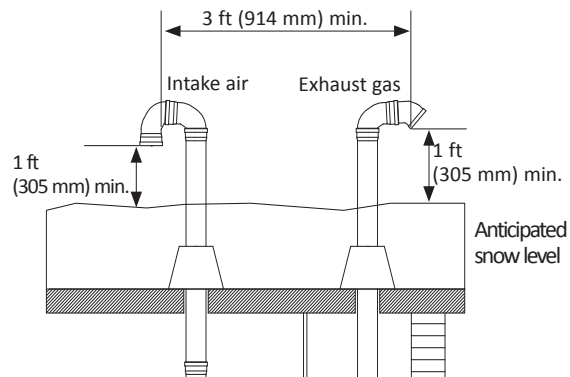
NOTICE

Canadian requirements differ from the guidelines in this section. In Canada, follow the requirements of B149.1 (Natural Gas and Propane Installation Code, current edition) as well as local and provincial codes. Contact your local code enforcement agency for direction.

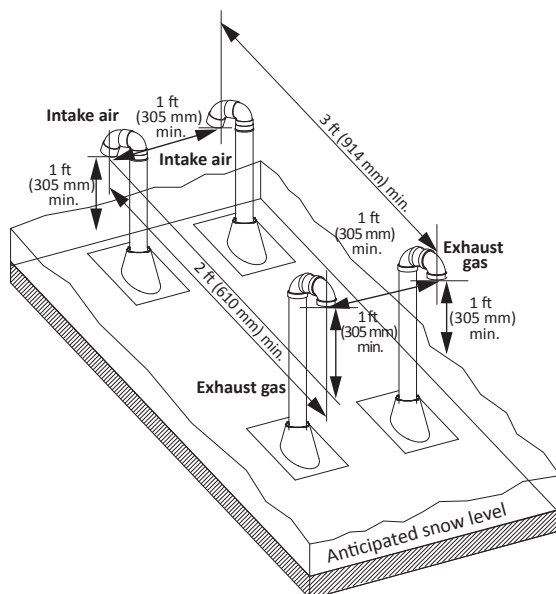
Angled roof termination



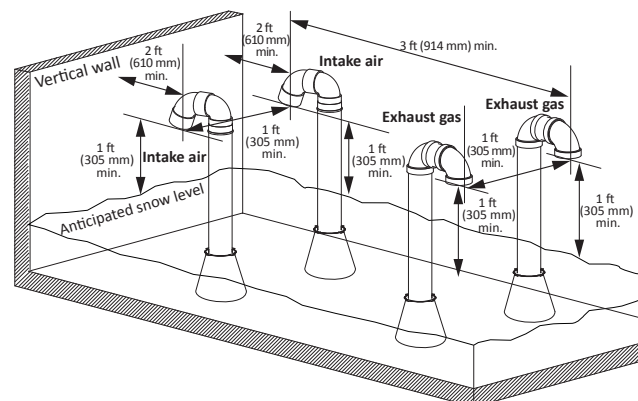
Flat roof termination



Multiple angled roof terminations



Multiple flat roof terminations



WARNING

- Exhaust terminations must be at least 1 ft (305 mm) away from any obstructions.
- Minimum spacing between multiple terminals:
 - intake terminals: 1 ft (305 mm) spacing between each
 - exhaust terminals: 1 ft (305 mm) spacing between each
- The exhaust termination must be a horizontal distance of at least 2 ft (610 mm) from a wall or surface unless specified differently by local code.
- Failure to observe this warning may result in severe personal injury or death.

GAS SUPPLY AND GAS PIPE SIZING

-General-



WARNING

- Do not use this water heater with any gas other than the one listed on the rating plate.
- Ensure that any and all gas regulators used are operating properly and providing gas pressures within the specified range shown below. Excess gas inlet pressure may cause serious accidents.
- Conversion of this unit from natural gas to propane or vice versa will void all warranty. Contact your local distributor to get the correct unit for your gas type. **The manufacturer is not liable for any property and/or personal damage resulting from gas conversions.**
- Failure to observe these warnings could result in severe personal injury, carbon monoxide poisoning, or death.

- The minimum and maximum inlet gas pressures are:

Gas type	Inlet gas pressure
Natural Gas	Min. 4.0" W.C. (1.00 kPa) – Max. 10.5" W.C. (2.61 kPa)
Propane	Min. 8.0" W.C. (1.99 kPa) – Max. 14.0" W.C. (3.48 kPa)

- 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 is in full operation and in standby.
- Inlet gas pressure must not exceed the above maximum values; gas pressure above the specified range will cause dangerous operating conditions and damage to the unit.
- Until testing of the main gas line supply pressure is completed, ensure the gas line to the water heater is disconnected to avoid any damage to the water heater.
- 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.
- The regulator must be sized for the water heater input and provide the specified pressures that are listed on the rating plate.
- In the absence of minimum install distance, it is recommended that there is at least 3 ft (1 m) of piping between the regulator outlet and the water heater's inlet gas connection.

-Gas connections-

1. Install a manual gas shutoff valve between the water heater and the gas supply line.
2. 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 shutoff 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 shutoff 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).
3. Always purge the gas line of any debris and/or water before connecting to the gas inlet.

NOTICE

Size the gas pipe appropriately to supply the necessary volume of gas required for the water heater using ANSI Z223.1/NFPA 54 in the USA or B149.1 in Canada or local codes. Otherwise, flow capabilities and output temperatures will be limited.

-Natural gas supply piping-

Maximum delivery Capacity in Cubic Feet of Gas per Hour (based on IPS Pipe carrying Natural Gas with 0.60 Specific Gravity with a Pressure Drop of 0.5" W.C.).

Based on Energy Content of 1,000 BTU/Cubic ft: The water heater requires 120 Cubic ft/hr for the 140 model.

The following tables are from NFPA 54.

Unit: Cubic feet per hour

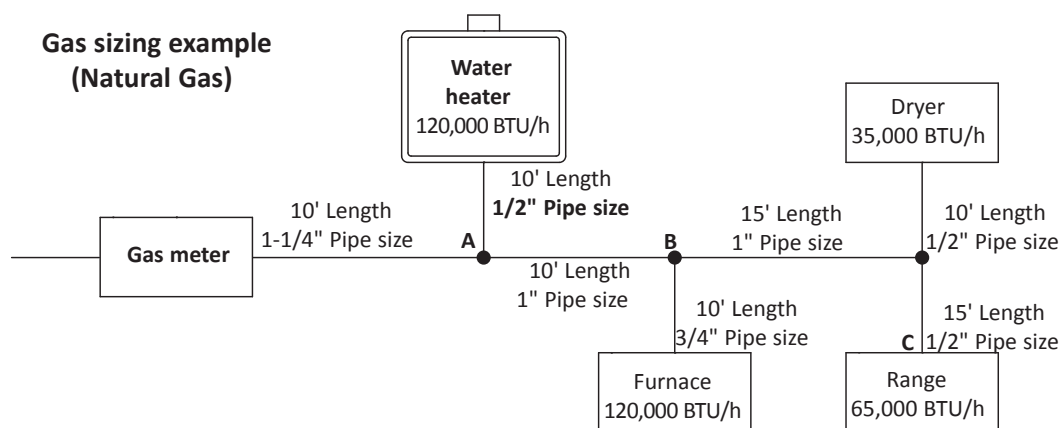
Pipe Size	Length												
Diameter	10' (3.0 m)	20' (6.1 m)	30' (9.1 m)	40' (12.2 m)	50' (15.2 m)	60' (18.3 m)	70' (21.3 m)	80' (24.4 m)	90' (27.4 m)	100' (30.5 m)	125' (38.1 m)	150' (45.7 m)	200' (61.0 m)
1/2" (13 mm)	172	118	95	81	72	65	60	56	52	50	44	40	34
3/4" (19 mm)	360	247	199	170	151	137	126	117	110	104	92	83	71
1" (25mm)	678	466	374	320	284	257	237	220	207	195	173	157	134
1 1/4" (32mm)	1,390	957	768	657	583	528	486	452	424	400	355	322	275
1 1/2" (38mm)	2,090	1,430	1,150	985	873	791	728	677	635	600	532	482	412
2" (51mm)	4,020	2,760	2,220	1,900	1,680	1,520	1,400	1,300	1,220	1,160	1,020	928	794

-Propane (LP) supply piping-

Maximum Capacity of Propane (LP) Based on 11" W.C. supply pressure at a 0.5" W.C. pressure drop

Unit: kBTU per hour

Pipe Size	Length												
Diameter	10' (3.0 m)	20' (6.1 m)	30' (9.1 m)	40' (12.2 m)	50' (15.2 m)	60' (18.3 m)	70' (21.3 m)	80' (24.4 m)	90' (27.4 m)	100' (30.5 m)	125' (38.1 m)	150' (45.7 m)	200' (61.0 m)
1/2" (13 mm)	268	184	148	126	112	101	93	87	82	77	68	62	53
3/4" (19 mm)	567	393	315	267	237	217	196	185	173	162	146	132	112
1" (25mm)	1,071	732	590	504	448	409	378	346	322	307	275	252	213
1 1/4" (32mm)	2,205	1,496	1,212	1,039	913	834	771	724	677	630	567	511	440
1 1/2" (38mm)	3,307	2,299	1,858	1,559	1,417	1,275	1,181	1,086	1,023	976	866	787	675
2" (51mm)	6,221	4,331	3,465	2,992	2,646	2,394	2,205	2,047	1,921	1,811	1,606	1,496	1,260



Based on Energy Content of 1,000 BTU/Cubic ft:

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, look in the above gas chart to properly size the line.

For sections of the gas line supplying gas to more than one appliance (Ex: Point A to Point B), add up the cubic ft 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 requirements and dividing by 1,000 yields a cubic ft per hour requirement of 220 cubic ft of gas per hour. The farthest appliance is the range, which is 50 ft away from the meter. Looking at the above chart, and under the column of 50 ft, Section A to B needs to be 1" in order to supply 220 cubic ft.

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!

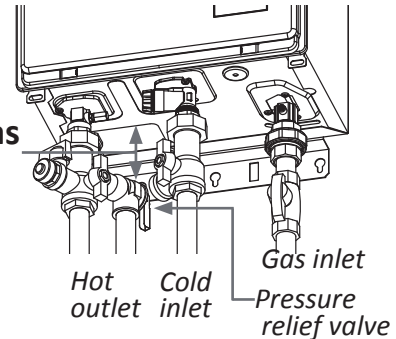
NOTICE

Do not reverse the hot outlet and cold inlet connections to the water heater. This will prevent the water heater from activating properly.

All pipes, pipe fittings, valves and other components, including soldering materials, must be suitable for potable water systems.

1. A manual shutoff valve must be installed on the cold water inlet to the water heater between the main water supply line and the water heater.
2. In addition, a manual shutoff valve is also recommended on the hot water outlet of the unit. 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.

As Close as Possible



3. 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.
4. There is a wire mesh filter within the cold inlet to trap debris from entering your heater. This will need to be cleaned periodically to maintain optimum flow. (Refer to p. 56.)

-Pressure relief valve-

The water heater has a high-temperature shutoff switch built in as a standard safety feature (called a Hi-Limit switch) therefore a **“pressure only”** relief valve is required.

- This unit does not come with an approved pressure relief valve.
- An approved pressure relief valve must be installed on the hot water outlet.
- The pressure relief valve must conform to **ANSI Z21.22** or **CAN 1-4.4** and installation must follow local codes.
- The discharge capacity must be at least 120,000 BTU/h for the 140 model.
- The pressure relief valve needs to be rated for a maximum of 150 psi (1 MPa).
- The discharge piping for the pressure relief valve must be directed so that the 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 within 6 in (152 mm) from the floor. 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. 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.
- No valve must be placed between the relief valve and the water heater.



WARNING

Hot water could be released when the pressure relief valve is opened. This could result in severe personal injury. 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.

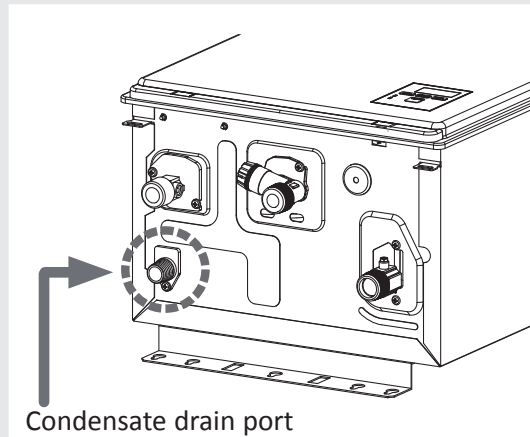
Refer to the pressure relief valve manufacturer's instructions for inspection and maintenance requirements.

CONDENSATE DRAIN

- The water heater does not include a built-in condensate neutralizer cartridge for reducing the pH level of condensate water. If local codes dictate that condensate must be neutralized prior to drainage, a condensate neutralizer must be installed. An accessory Neutralizer assembly (100112159/TH-NT01) is sold separately. (Refer to p. 10.)
- In the absence of applicable local codes and regulations, the manufacturer recommends that condensate be disposed of into a drain. Connect a drain tube from the condensate drain port (shown below) located on the bottom of the water heater to a standard drain.

NOTICE

Follow all code requirements of the local authority for condensate neutralizers and whether or not they are required for the installation.



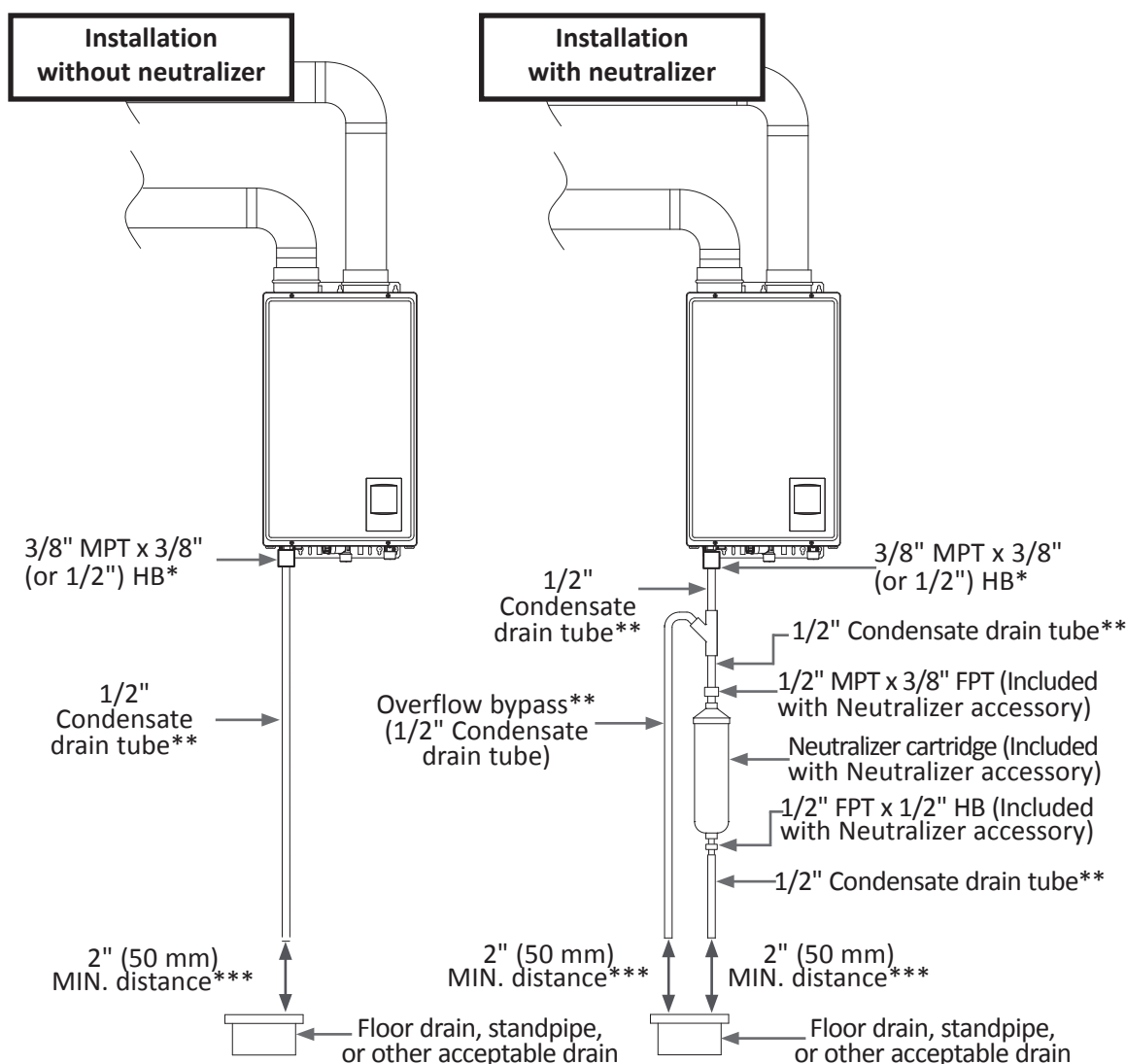
-Condensate drain connections-

NOTICE

- Discharge condensate (acidic water) in accordance with all local codes and common safety practices.
- Use corrosion resistant pipe, such as PVC, for the condensate drain line. Do not use metal pipe.
- The condensate drain does not require a trap.
- Maintain a downward slope on the drain line(s), including installations in which the drain is not directly below the water heater.
- A field-supplied bypass is required if a neutralizer is installed.
- Do not connect the condensate drain line directly to a condensate pump.
- If the drain line is required to have bends, ensure that there are no kinks that will restrict the flow of condensation.

The water heater is a high efficiency condensing water heater that produces condensate (acidic water). The acidic condensate generated in the secondary heat exchanger can be neutralized by the neutralizer accessory (100112159/TH-NT01).

Although a neutralizer is not required, a condensate drain must be installed as described on the next page.



*Connect to the condensate drain port. (Refer to p.31.)

**Maintain downward slope, including installations in which the drain is not directly below the heater.

***A 2" (50 mm) minimum distance must be maintained between the condensate line and drain to allow full flow of the condensation.

NOTICE

- The condensate drain is at atmospheric pressure (non-pressurized) and therefore must be allowed to drain freely with gravity only. Ensure that the condensate drain tube is not plugged or blocked, and ensure that it slopes downward to allow condensate to flow freely. **All portions of the condensate drain (neutralizer and drain tube) must be at a lower elevation than the water heater to prevent condensate water from building up inside the heat exchanger.**
- Condensate cannot be effectively neutralized if the neutralizer elements inside the Neutralizer accessory have been completely consumed. If this happens, condensate will remain acidic and can possibly cause damage to items such as pipes, concrete, etc., if drained improperly.
- The actual life of the neutralizer may vary, depending on the application and usage. Replace the cartridge when the condensate pH goes below 6.0.
- Please ensure that the cartridge is properly replaced before the neutralizer elements have been completely consumed.
- All preventative measures and safety practices must be adhered to when draining condensate. The manufacturer will not be responsible for any damage caused by condensate.
- A drain pan, or other means of protection against water damage, is recommended to be installed under the water heater in case of leaks.

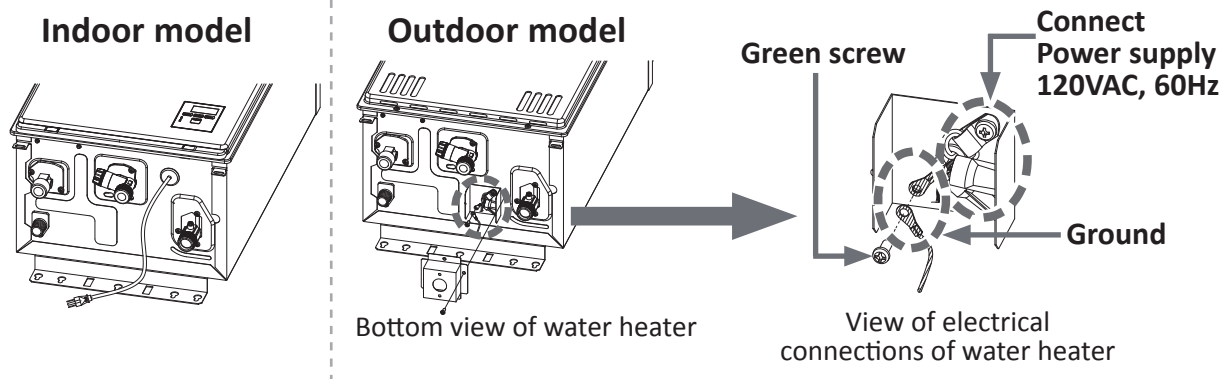
ELECTRICAL CONNECTIONS



- Ensure that circuit power is turned OFF before you complete the following steps.
- 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 in the U.S. or the current edition of CSA C22.1 Canadian Electrical Code Part 1 in Canada.
- When servicing or replacing parts within the water heater, label all wires prior to disconnection to facilitate an easy and error-free reconnection. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.
- Failure to observe these warnings could result in personal injury or loss of life.

Indoor model comes with a power plug instead of a junction box. The following procedure is for the outdoor model only.

1. The water heater must be electrically grounded. Do not attach the ground wire to either the gas or the water piping.
2. 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. (Must comply with local codes.)
 - Connect the power supply to the water heater exactly as shown in the wiring diagram.
3. A green screw is provided in the junction box to ground the connection.
4. Can be hardwired or wired to a plug-in.
5. The use of a surge protector is recommended in order to protect the water heater from power surges.

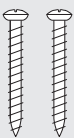
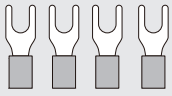
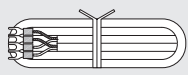


TEMPERATURE REMOTE CONTROLLER

-Included accessories-Outdoor model only

- The remote control is an optional accessory that can be installed in a hall, closet, etc., to allow for temperature adjustment without having to go to the heater.
- When installed, the remote will take priority over the built-in controller of indoor model.

Verify that the items listed below are included with the remote controller.

Temperature remote controller	Screws	Fork terminals	Manual	Remote controller cable*
 Qty: 1	 Qty: 2	 Qty: 4	 Qty: 1	 Qty: 1

100209924 (TM-RE42)

It is also an optional accessory as a second remote for the indoor model. Refer to pp. 9 and 10.

*The optional remote controller (sold separately) has no remote controller cable.

-Installation-



WARNING

- **This remote controller is NOT waterproof.**
- **The water heater can only have one remote controller.**
- Do not install in high temperature environments, high humidity conditions outdoors, in direct sunlight, or within the reach of children.
- Make sure the remote controller does not come into contact with water or oil.
- Failure to observe these warnings could result in personal injury or electrical shock.

NOTICE

- Do not place the remote controller cable close to other wires from other products.
- Cables used for the remote controller connection must be:
 - Minimum 20 gauge wire (No polarity)
 - Maximum 400 ft (122 m) long

<Mounting and Wiring the Remote Controller>

1. Take off the **Back plate** from the remote controller with a flat head screwdriver. (Fig. A and B)
2. Attach the **Back plate** on the wall with the two provided screws. (Fig. B)
3. If you use another cable, crimp the **Fork terminals** to the wires. (Fig. C)

Fig. A

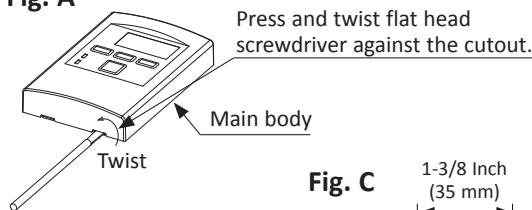


Fig. B

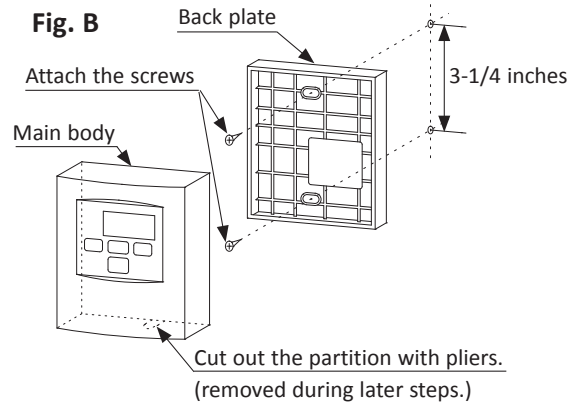
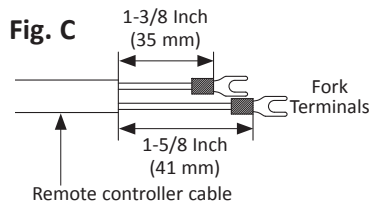


Fig. C



4. Tighten the two **Fork terminals** beneath the two **Remote controller terminal** screws on the back of the main body. (Fig. D-1)
5. Cut out the inlet for the remote controller cable from the bottom of the main body. (Fig. D-2)
6. Place the **Main body** back on the **Back plate**, with the **Remote controller cable** running out of the bottom inlet.

Fig. D-1

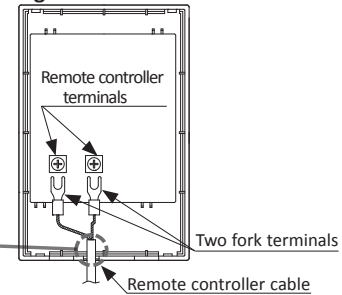
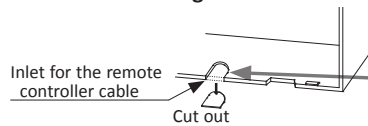


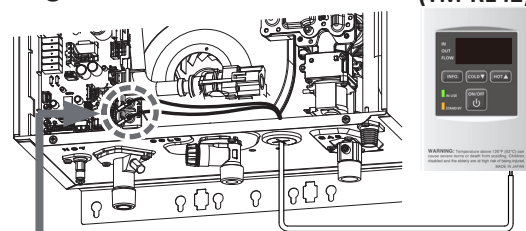
Fig. D-2



<How to connect the remote controller to the water heater>

1. Disconnect power supply from the water heater.
2. Take off the water heater's front cover.
3. Locate the two terminals for the remote controller in the water heater. (Refer to the Fig. E-1.)
4. Take off the back plate from the remote controller, and then attach the two fork terminals to the connector base on the back side of the remote controller with two screws. Make sure the terminals are firmly fixed. (See the above instructions for installation of the remote controller.)
5. Pull the remote controller cable through the hole at the bottom of the water heater's casing.
6. Secure both controller cable terminals to the terminals on the computer board as shown below. (Secure them underneath the screw terminals. No polarity.)
 - * Do NOT jump or short-circuit the cables, or computer will be damaged.
7. Replace the front cover securely.

Fig. E-1



APPLICATIONS

-Space-Heating Applications-



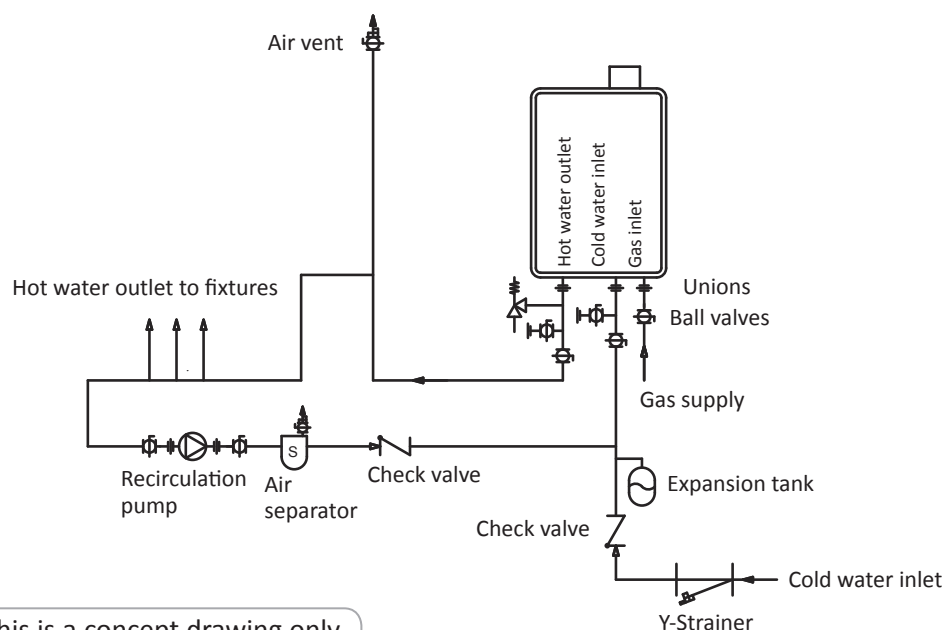
WARNING

- This water heater is suitable for combination water (potable) heating and space heating and not suitable for space heating applications only.
- In order to purge air in water pipes within a closed-loop system, an air vent and air separator should be installed in the system. Required circulation flow rates are labeled next to each application diagram. These flow rate requirements must be followed.
- Toxic chemicals used in boiler treatments such as alcohol, glycerol and glycol groups must not be introduced into the system if the system incorporates an open-loop potable water system.
- The water heater can be used to supply potable water and space heating and shall not be connected to any heating system or component(s) previously used with non-potable water where any chemicals were added to the water heating appliances.
- When the system requires water for space heating at temperatures higher than required for other uses, a means such as a mixing valve shall be installed to temper the water for those other uses in order to reduce scald hazard potential.
- Water temperature over 125 °F (52 °C) can cause severe burns instantly or death from scalding.

-Recirculation-

*The recirculation pump is to be controlled by:
-Dual-set aquastat (recommended w/timer)

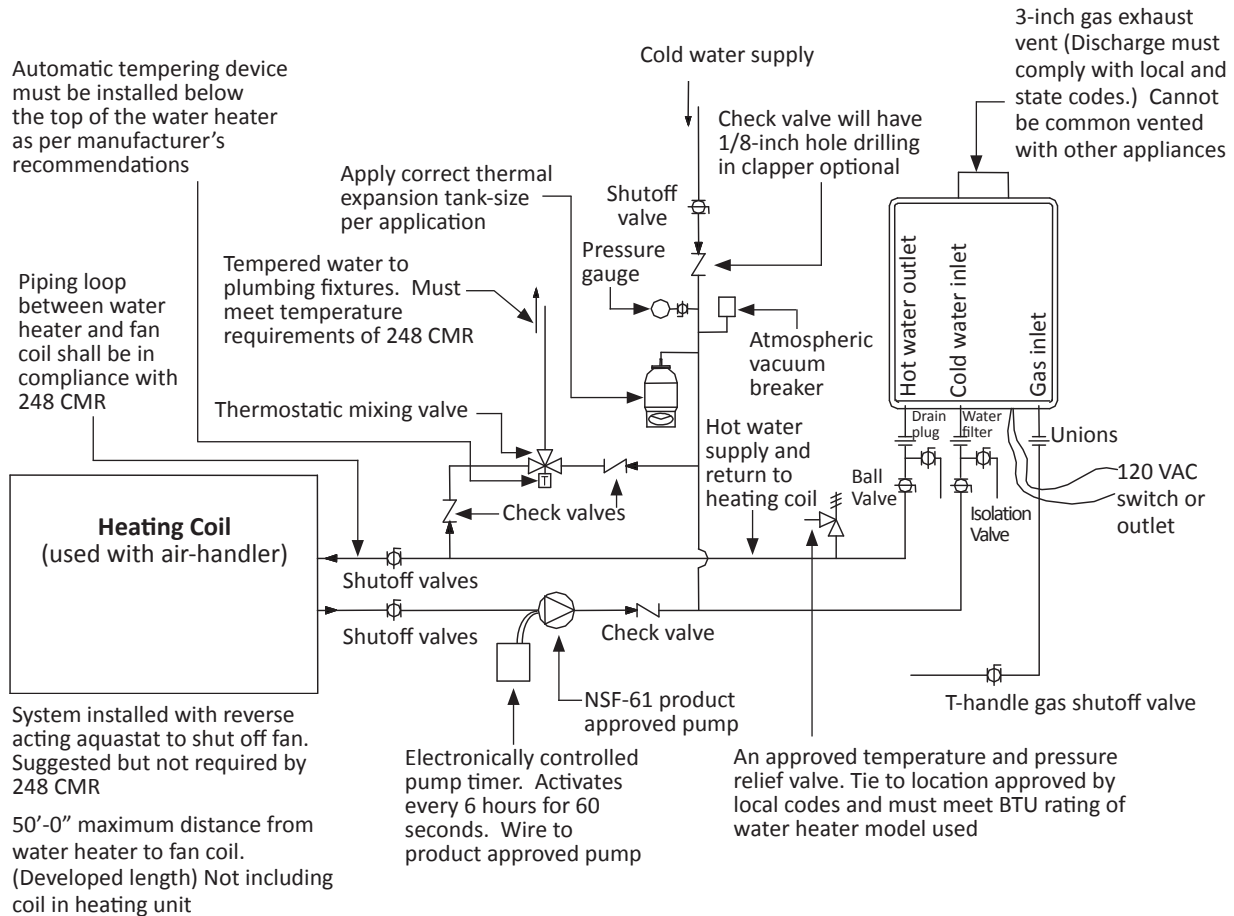
*The recirculation pump is to provide no less than 2 GPM (7.5 L/min) and no more than 4 GPM (15 L/min) through each activated unit in the system.



-Dual-purpose hot water heating- (Domestic and Space Heating):

Diagrammatic layout of radiant heating and domestic water heater.

All water piping should be insulated in accordance with 780 CMR (Massachusetts energy code)



The recirculation pump is to provide no less than 2 GPM (7.5 L/min) and no more than 4 GPM (15 L/min) through each activated unit in the system.

NOTICE

- **Priority Control Devices** such as a flow switch, an Aquastat or other electronic controller can be used to prioritize the domestic water system over the heating system.
- Follow all local codes, or in the absence of local codes, follow the most recent edition of the National Standard Code, ANSI Z21.10.3.
- This illustration is a concept design only. The reference to the 1/8th hole in check is only for the State of Massachusetts. There are a wide variety of variations to the application of controls and equipment presented. Designers must add all necessary safety and auxiliary equipment to conform to code requirements and design practice. For more details, contact the manufacturer.

INITIAL OPERATION

FOR YOUR SAFETY, READ BEFORE OPERATING

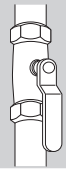
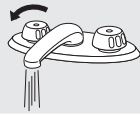
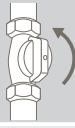
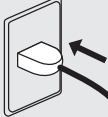
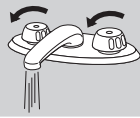
- **Check the GAS and WATER CONNECTIONS** for leaks before firing unit for the first time.
- Open the main gas supply valve to the unit using only your hand to avoid any spark. Never use tools. If the knob will not turn by hand, do not try to force it; call a qualified service technician. Forced repair 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 pp. 28 and 45.
- Do not try to light the burner manually. It is equipped with an electronic ignition device which automatically lights the burner.
- **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!

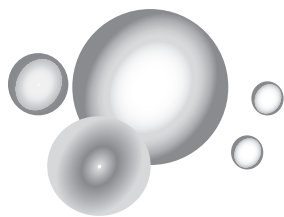


WARNING

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.

	Operation	
1.	Once the above checks have been completed, please clean filter of any debris. Refer to p. 45 for instructions.	
2.	Fully open the manual water control valve on the water supply line.	
3.	Open a hot water tap to verify that water is flowing to that tap, then close the hot water tap.	
4.	Fully open the manual gas control valve installed.	
5.	Turn on the 120 VAC, 60 Hz power supply to the water heater.	
6.	Now you are ready to enjoy hours of endless hot water.	



Owner's Guide

CONGRATULATIONS

Congratulations and thank you for choosing our tankless water heater. Before use, we recommend that you read through this owner's guide carefully. Keep this manual for future reference.

If you need an additional manual, contact the manufacturer or your local distributor. When you call, please tell us the product name and the serial number of your unit written on the rating plate of the water heater.

OPERATING SAFETY

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

C. Use only your hand to 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 electric 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.



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

FLAMMABLES

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

Keep flammable products:

1. Far away from heater.
2. In approved containers.
3. Tightly closed and out of reach of children.
4. Water heater has a main burner, which may come on at any time and will ignite flammable vapors.

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.

⚠ 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. 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.
6. 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.

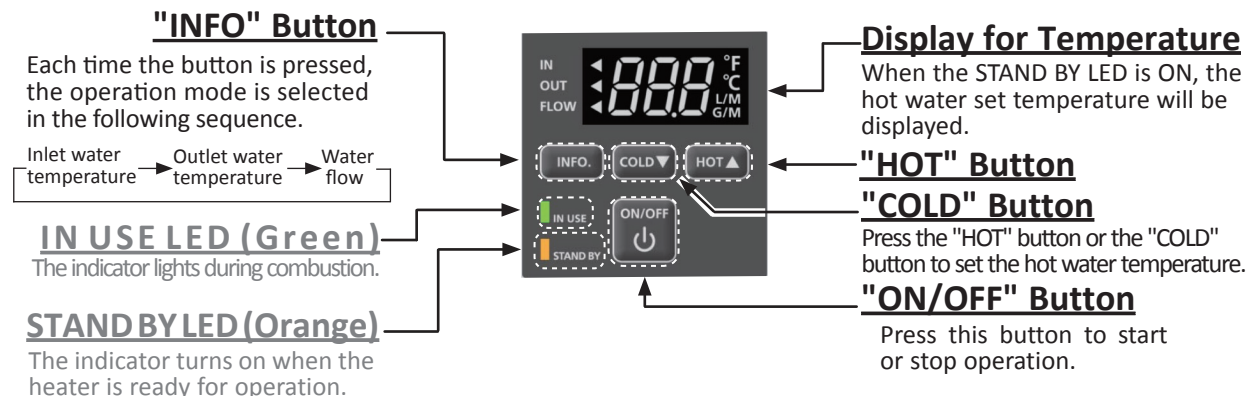
No valve shall be placed between the relief valve and the water heater. The relief from the discharge of the pressure relief valve shall be disposed of in a suitable place where it will cause no damage. Also, there shall be no other reducing coupling or other restrictions installed on the discharge line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

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

NORMAL OPERATION

BUILT-IN AND REMOTE CONTROLLER

The illustration below shows an example of the display of the controllers. The exact display may differ from examples.



NOTICE

- When the remote controller is installed, it will take priority over the built-in controller.
- The controller has an energy saving mode. Five minutes after the water heater stops operating, the backlight of the controller turns off.
- The backlight of the remote will turn back on once the water heater begins firing again.

GENERAL

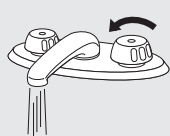


WARNING

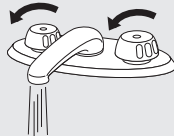
Temperatures above 125 °F (52 °C) can cause severe burns or death from scalding. Children, disabled and the elderly are at high risk of being injured.

°F	120	125	130	135	140	145	150	155
°C	49	52	54	57	60	63	66	68
Time to produce serious burn	more than 5 min.	1½ to 2 min.	about 30 sec.	about 10 sec.	less than 5 sec.	less than 3 sec.	about 1½ sec.	about 1 sec.

1. Open a cold water fixture.



2. Mix hot water with the cold water to get the correct temperature water.



3. When finished, close the water fixtures.



NOTICE

- Flow rate to activate the water heater: 0.5 gallon per minute at the default set temperature (1.9 L/min).
- Flow rate to keep the water heater running: 0.4 gallon per minute (1.5 L/min).

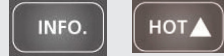
TEMPERATURE TABLE OF THE CONTROLLER

°F	100	105	110	115	120*	125	130	135	140
°C	38	40	43	45	50*	52	55	57	60

*Factory setting (Default)

TEMPERATURE SETTINGS

-Using controller-

	Operation	Screen on the controller
1.	Turn on the 120 VAC power supply to the water heater.	
2.	Press the "ON/OFF" button on the controller in order to turn the controller on.	
3.	When ON, the STAND BY LED is lit.	
4.	It shows the set temperature on its display as shown in the picture on the right. (EX.: 120 °F)	 (EX.: 120 °F)
5.	Press the "HOT" button or the "COLD" button to set the temperature setting of the unit.	
	Increasing temperature from 120 °F (50 °C) to 125 °F (52 °C) : 1. The water heater must be Stand By to increase the temperature. 2. Press the "HOT" button to set 120 °F (50 °C). 3. Press and hold the "INFO" button and the "HOT" button for at least 3 seconds. The remote will emit a beep and change to 125 °F (52 °C). 4. Press the "HOT" button to set up to 140 °F (60 °C).	

-Temperature setting on the PCB- (Without controller)



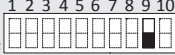
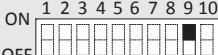
WARNING

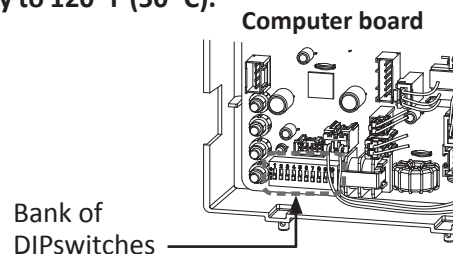
- Adjust the appropriate DIP switches according to temperature as shown below. **DO NOT** adjust the other DIP switches.
- Turn off the power supply to the water heater before changing the DIP switch settings.
- Failure to observe these warnings could lead to carbon monoxide poisoning, severe personal injury, or death.

There are 2 preset temperatures, 120 °F (50 °C) and 140 °F (60 °C), that you can select from by changing the DIP switch settings on the computer board without the controller. See below.

When the controller is in normal operation, the set temperature of the controller is given priority over the set temperature of the DIP switch settings.

- The temperature has been preset at the factory to 120 °F (50 °C).

120 °F (50 °C) DEFAULT	140 °F (60 °C)
ON 1 2 3 4 5 6 7 8 9 10 OFF 	ON 1 2 3 4 5 6 7 8 9 10 OFF 
No. 9 : OFF	No. 9 : ON



NOTE: The dark square indicates the correct DIP switch position.

ADDITIONAL FEATURES

-Information mode-

You can get some information about the water heater condition by pressing the **"INFO"** button. For more information, follow the procedures below:

INFO BUTTON	Operation	Screen on the controller
1st. press	Inlet water temperature will be displayed on the controller by pressing the "INFO" button.	 Inlet water temperature (EX.: 60 °F)
2nd. press	Outlet water temperature will be displayed on the controller by pressing the "INFO" button.	 Outlet water temperature (EX.: 120 °F)
3rd. press	Water flow rate, in gpm, will be displayed on the controller by pressing the "INFO" button.	 Water flow (EX.: 3.5 GPM)
4th. press	Press the "INFO" button to exit information mode.	

-Unit conversion mode-

Units of measure 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:

	Operation	Screen on the controller
1.	Press the "ON/OFF" button on the controller in order to turn the controller on.	
2.	When ON, the orange LED is lit.	
3.	The previous set temperature will be displayed on the screen.	 (EX.: 100 °F)
4.	Press the "INFO" buttons for at least 3 seconds.	
5.	The set temperature should now be displayed in the alternate unit of measurement.	 (EX.: 38 °C)

NOTICE

When the water heater is connected with the remote controller, the built-in controller will not operate temperature settings. It will only work for the information mode (Indoor model only).

FLOW

- The flow rate through the water heater is limited to a maximum of 7.0 GPM (26.5 L/min).
- The temperature setting, along with the supply temperature of the water, will determine the flow rate output of the water heater.
- Please refer to the temperature vs. gallons per minute charts on p. 56 to determine the likely flow rates based on your local ground water temperature and your desired outlet water temperature.
- Refer to the table on the right for typical household plumbing fixture flow rates to determine what the water heater can do in a household application.

Household Flow Rates

Appliance/Use	Flow rate	
	GPM (US)	L/min
Lavatory Faucet	1.0	3.8
Bath Tub	4.0 – 10.0	15.2 - 37.8
Shower	2.0	7.5
Kitchen Sink	1.5	5.6
Dishwasher	1.5	5.6
Washing machine	4.0	15.2

Taken from UPC 2006

FREEZE PROTECTION SYSTEM

- This water heater comes equipped with heating blocks to protect the unit from damage associated with freezing. When the freeze protection thermostat senses air temperature below 36.5 °F (2.5 °C), the blocks will heat up to prevent freezing of the unit.
- To operate these freeze protection systems, there has to 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.
- In any areas subject to freezing temperatures, the manufacturer highly recommends an indoor installation with an indoor model.
- The manufacturer also highly recommends the use of a backflow preventer (sold separately) to minimize the amount of cold air entering through the exhaust venting when the water heater is off.
- 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.
- If you will not be using your heater for a long period of time:
 1. Completely drain the water out of the unit. Refer to p. 45.
 2. Disconnect power to your heater.

This will keep your unit from freezing and being damaged.

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.

MAINTENANCE AND SERVICE

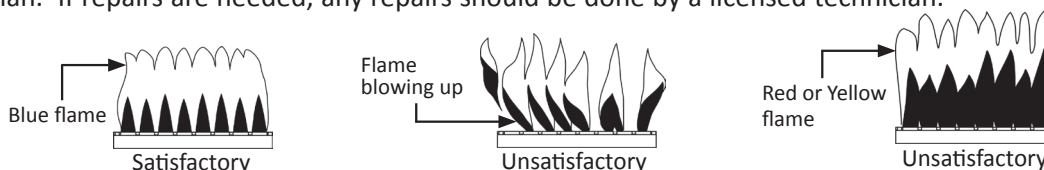


WARNING

- **Turn off the electrical power supply and close the manual gas shutoff valve and the manual water control valve before servicing.**
- **Failure to do so could result in severe personal injury, or death.**

- Clean the cold-water inlet filter. (Refer to the Unit Draining and Filter Cleaning Section on p. 45.)
- Be sure that all openings for combustion and ventilation air are not blocked.
- The venting system should be checked annually for any leaks, corrosion, blockages or damage.
- The burner should be checked annually for dust, lint, grease or dirt.
- Keep the area around the water heater clear. Remove any combustible materials, gasoline or any flammable vapors and liquids.
- If the 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.
- Visually check the burner flames through the burner window in the burner assembly located at the middle of the water heater. (See the following page.)

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



-Measuring inlet gas pressure-

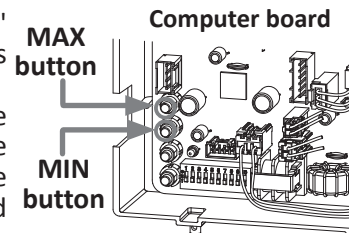
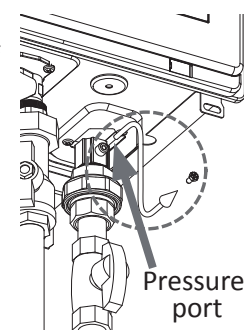


WARNING

1. Turn off all electric power to the water heater if service is to be performed.
2. Turn the manual gas valve located on the outside of the unit to the off position.
3. Failure to follow these steps could lead to fire or explosion, resulting in personal injury or death.

The water heater cannot perform properly without sufficient inlet gas pressure. Below are instructions on how to check the inlet gas pressure. **THIS IS ONLY TO BE DONE BY A LICENSED PROFESSIONAL.**

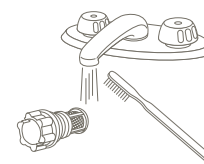
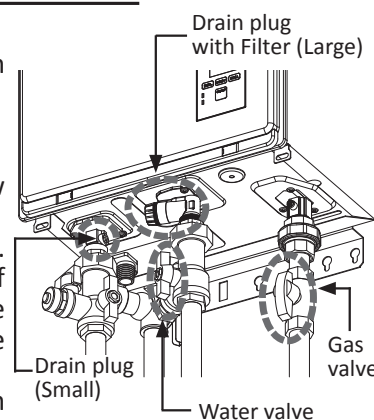
1. Shut off the manual gas valve on the gas supply line.
2. Remove the screw from the pressure port which is located on the gas inlet of the water heater shown in the diagram on the right.
3. Connect the manometer to the pressure port and zero the manometer.
4. Re-open the manual gas valve. Verify that there are no gas leaks.
5. With all gas burning equipment off, take a reading of the static gas pressure and make a note of it.
6. Measure gas supply pressure at maximum heater operation: Open hot water faucets to create maximum flow. Press the MAX button on the computer board. (Refer to the diagram below.) Take a reading of the supply dynamic gas pressure with all gas burning equipment running at maximum rate.
7. The static and dynamic pressures should be within the ranges specified on the heater's rating plate and the table on p. 28
8. The difference of static to dynamic pressure should not exceed 1.5" W.C. Pressure drops that exceed 1.5" W.C. can indicate restricted gas flow, undersized gas lines, and/or undersized supply regulators.
9. Measure gas supply pressure at minimum heater operation: Reduce water flow so the heater is running at minimal operation. Press the MIN button on the computer board. (Refer to the right diagram.) Take a supply gas pressure reading and verify that it is within the specified inlet gas pressure range.



UNIT DRAINING AND FILTER CLEANING

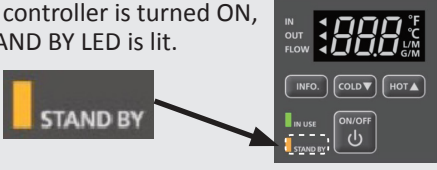
1. Close the manual gas shutoff valve.
2. Turn off power to the unit and wait a couple of seconds. Turn on again.
3. Wait 30 seconds, and then turn off power to the unit.
4. Close the **inlet** water valve.
5. Open all hot water taps in the house. When the residual water flow has ceased, close all hot water taps.
6. Have a bucket or pan to catch the water from the unit's drain plugs. If isolation valves are installed, open the drains to drain the water. If isolation valves are not installed, **unscrew** the two drain plugs (large and small) to drain all the water out of the unit. Do not lose the o-rings that will be on the two drain plugs.
7. Wait a few minutes to ensure all water has completely drained from the unit.
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 and reinsert the filter back into the cold water inlet.
9. Securely screw the drain plugs back into place.

Hand- tighten only.



TROUBLESHOOTING

	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. (p. 35)
	The water is not hot enough.	- Compare the flow and temperature. See the charts on p. 56. - Check cross plumbing between the cold water lines and hot water lines. - Is the gas supply valve open fully? (p. 37) - Is the gas line sized properly? (p. 28) - Is the gas supply pressure sufficient? (pp. 28 and 45) - Is the set temperature set too low? (p. 42)
	The water is too hot.	Is the set temperature set too high? (p. 42)
	The hot water is not available when a fixture is opened.	- Make sure the unit has a 120 VAC, 60 Hz power supply. - If you are using the remote controller and/or built-in controller, is the power button turned on? - 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. - Is the gas supply valve open fully? (p. 37) - Is the water supply valve open fully? (p. 37) - Is the filter on the cold water inlet clean? (p. 45) - Is the hot water fixture open sufficiently to draw at least 0.5 GPM (1.9 L/min) through the water heater? (p. 41) - Is the unit frozen? (p. 44) - Is there enough gas in the tank / cylinder? (For Propane model) - Is it plumbed backwards with reverse plumbing?
	The hot water turns cold and stays cold.	- Is the flow rate enough to keep the water heater running? (p. 41) - If there is a recirculation system installed, does the recirculation line have enough check valves? (p. 35) - Is the gas supply valve open fully? (p. 37) - Is the filter on the cold water inlet clean? (p. 45) - Are the fixtures clean of debris and obstructions?
	Fluctuation in hot water temperature.	- Is the filter on the cold water inlet clean? (p. 45) - Is the gas line sized properly? (p. 28) - Is the supply gas pressure sufficient? (pp. 28 and 45) - Check for cross connection between cold water lines and hot water lines.
WATER HEATER	Unit does not ignite when water goes through the unit.	- Is the power on the water heater? - Is the gas on? - Is the flow rate over 0.5 GPM (1.9 L/min)? (p. 41) - Is the filter on the cold water inlet clean? (p. 45) - Check for reverse connection and cross connection. (p. 30) - If you use the remote controller and/or built-in controller, is the power button turned on? (p. 41) - Check if the inlet temperature is too high. If it is too close to the set temperature, the water heater will not activate.

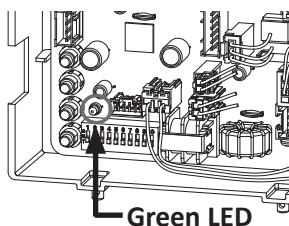
	PROBLEM	SOLUTIONS
WATER HEATER	The fan motor is still spinning after operation has stopped.	This is normal. After operation has stopped, the fan motor keeps running from 15 to 70 seconds in order to re-ignite quickly, as well as purge all the exhaust gas out of the flue.
	Unit sounds abnormal while in operation	Contact the manufacturer at 1-877-737-2840.
BUILT-IN/REMOTE CONTROLLER	Controller does not display anything when the power button is turned on.	- Make sure the water heater is supplied with power. - Make sure the connection to the water heater is correct. (p. 34) When the controller is turned ON, STAND BY LED is lit.  NOTICE: When the water heater has not operated for five minutes or more, the display of the controllers turns off to conserve energy.
	An ERROR code is displayed.	Please see pp. 48 and 49.

ERROR CODES

- The water heater has self-diagnostics for safety and convenience when troubleshooting.
- If there is a problem with the water heater itself, or the installation of the unit, the error code will be displayed on the temperature controller and remote controller.
- Consult with the table on the following pages for a description of each error code.



Error code indicator on the built-in/remote controller



Green LED

Error code on the computer board
Indicated by 1/2-second flashes on the Green LED.

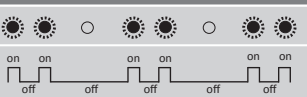
Example: If your unit has a “321” error code (which signifies an inlet thermistor failure)

- Indicator on the built-in controller or remote controller : “321” will be displayed on the screen.



Error code

- Green LED on the computer board:** The green LED on the computer board will indicate this code with two flashes every 1/2 second. The pattern will repeat with a three second delay between patterns.

Error code	Green LED
321	

Error Indication

Error Code on the temperature controller	The number of flashes	Flash pattern	Error Code on the temperature controller	The number of flashes	Flash pattern
031 701 711	One		611	Four	
311 321 341 391	Two		101 941 991	Five	
111 121	Three		510 551 721	Six	

-Fault Analysis of Error Codes-

If the error code is displayed on the computer board of the water heater or remote controller and/or temperature controller, please check the following. After checking, **consult with the manufacturer**.

Remote	Green LED	Malfunction description	Diagnosis
031	One Time	Incorrect DIP switch setting	Check the DIP switch settings on the PCB (Part #701).
101	Five Times	Warning for the "991" error code	- Check if the gas type of the water heater matches the gas supplied to it. - Check if there is any blockage in the intake air and/or exhaust. - If the water heater is installed as a direct-vent system, check whether there is enough distance between the intake air terminal and the exhaust terminal. - Check the altitude/elevation of area of where the water heater is installed and match the appropriate DIP switches. - Check if there is grease and/or dirt in the burner (Part #101) and the fan motor (Part #103), especially if the water heater has been installed in a contaminated area. - Check if the DIP switches match gas type of the water heater. - Check the manifold pressure at Max. and Min. - Check combustion chamber tube (Part #117) to make sure it is clear and securely installed.
111*	Three Times	Ignition failure	- Check if the Hi-limit switch (Part #411) is properly functioning. - Check for connection/breakage of wires (Part #412, 707, 708, 709 710), burn marks on the computer board (Part #701), and/or soot on the flame rod (Part #108). - Check if there is a buzzing spark ignition sound coming from the burner (Part #101) when water heater prepares for combustion. - Listen for the double "clunk" sound coming from gas valve assembly (Part #102) when the water heater goes into combustion. - Check if there is leaking from heat exchanger (Part #401). - Check that the gas is turned on. - Check gas supply.
121*	Three Times	Loss of flame	- Check if the Hi-limit switch (Part #411) is properly functioning. - Check for connection/breakage of wires (Part #412, 707, 708, 710), burn marks on the computer board (Part #701), and/or soot on the flame rod (Part #108). - Check if there is leaking from heat exchanger (Part #401). - Check gas supply.
311*	Two Times	Outlet thermistor failure	- Check for connection/breakage of wires and/or debris on thermistor (Part #407, 408, 715). - Check the resistance.
321*	Two Times	Inlet thermistor failure	
341*	Two Times	Exhaust thermistor failure (Indoor model only)	

***These error codes will be cleared when water flow stops.**

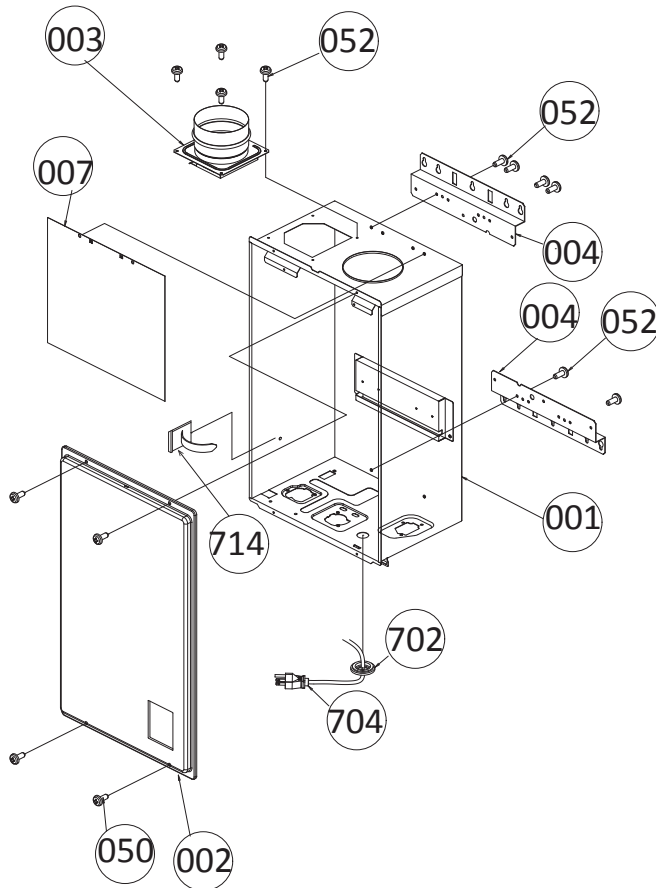
Remote	Green LED	Malfunction description	Diagnosis
391*	Two Times	Air-fuel ratio rod failure	Check for connection/breakage of wires (Part #708) and/or soot on the AFR rod (Part #108).
510	Six Times	Abnormal main gas solenoid valve	- Check for connection/breakage of wires (Part #707) and/or burn marks on the computer board (Part #701). - Check for signs of vent corrosion. - Check gas valve contacts and gas valve wire harness connections for signs of rust or corrosion.
551	Six Times	Abnormal gas solenoid valve	- Check for connection/breakage of wires (Part #707) and/or burn marks on the computer board (Part #701). - Check gas valve contacts and gas valve wire harness connections for signs of rust or corrosion..
611*	Four Times	Fan motor fault	- Check for connection/breakage of wires, dust buildup in the fan motor (Part #103) and/or burn marks on the computer board (Part #701). - Check for frozen/corrosion of connectors (Part #103).
701*	One Time	Computer board fault	Check for connection/breakage of wires (Part #711).
711*	One Time	Gas solenoid valve drive circuit failure	Refer to the 111 and 121 error codes.
721*	Six Times	False flame detection	Check if there is leaking from heat exchanger (Part #401).
741	N/A	Miscommunication between the water heater and remote controller	- Check the model type of the remote controller. - Inspect the connections between the water heater and remote controller. - Check the power supply of the water heater.
751	N/A	Miscommunication between the water heater and built-in controller (Indoor model only)	- Inspect the connections between the water heater and temperature controller. - Check the power supply of the water heater.
941	Five Times	Abnormal exhaust temperature (Indoor model only)	Check to see if the exhaust temperature is higher than 149°F (65°C).
991	Five Times	Imperfect combustion	- Check if the gas type of the water heater matches the gas supplied to it. - Inspect the environment around the water heater. Determine how long the water heater has been installed and match DIP switches. - Check the altitude/elevation of the area of where the water heater is installed. - Check if there is any blockage in the intake air and/or exhaust. - If the water heater is installed as a direct-vent system, check whether there is enough distance between the intake air terminal and the exhaust terminal. - Check if there is grease and/or dirt in the burner (Part #101) and the fan motor (Part #103), especially if the water heater has been installed in a contaminated area - Check the DIP switches match gas type of the water heater. - Check the manifold pressure at Max. and Min. - Check combustion chamber tube (part #117) to see if it is clear and securely installed.

*These error code will be clear when water flow stops.

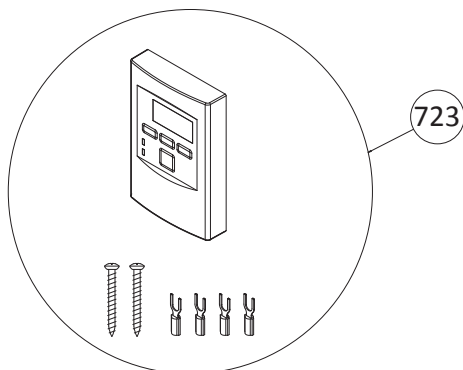
COMPONENTS DIAGRAM

Case assembly

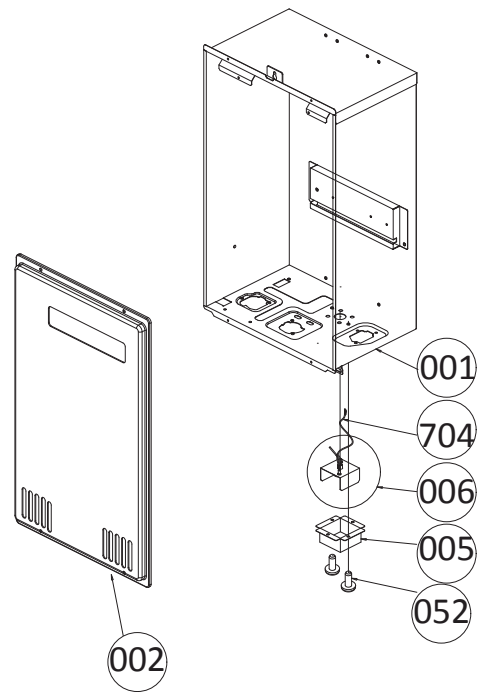
Indoor model



Temperature remote controller

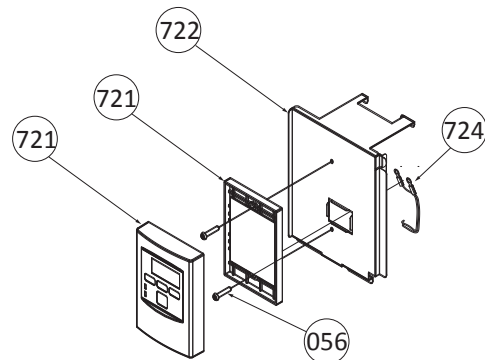


Outdoor model

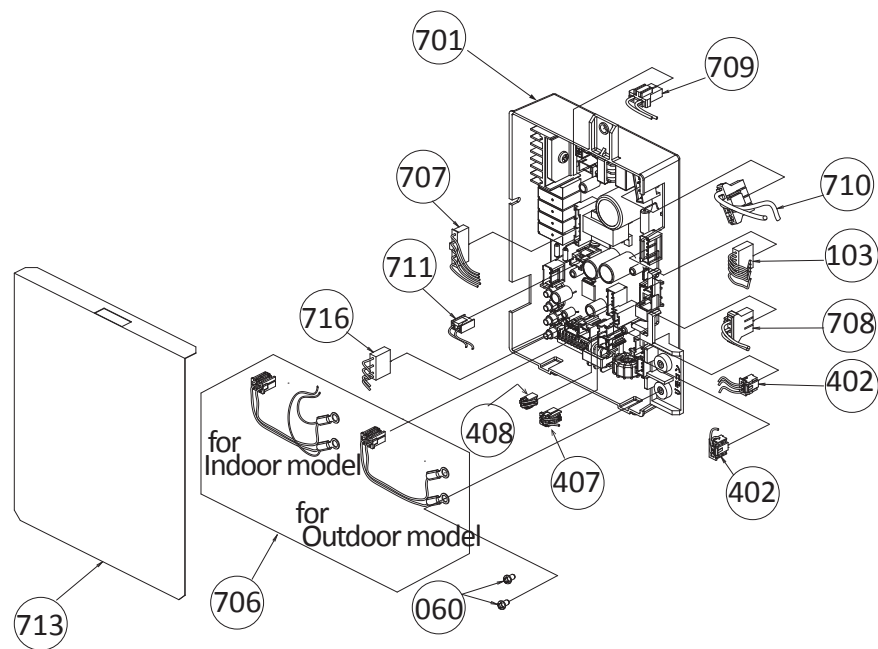


Built-in controller

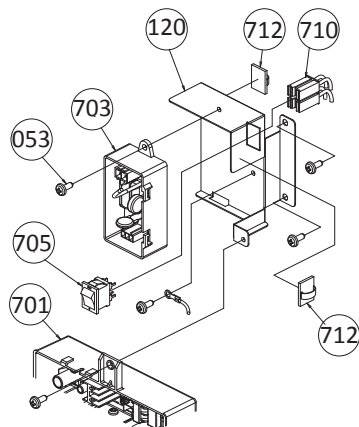
Indoor model



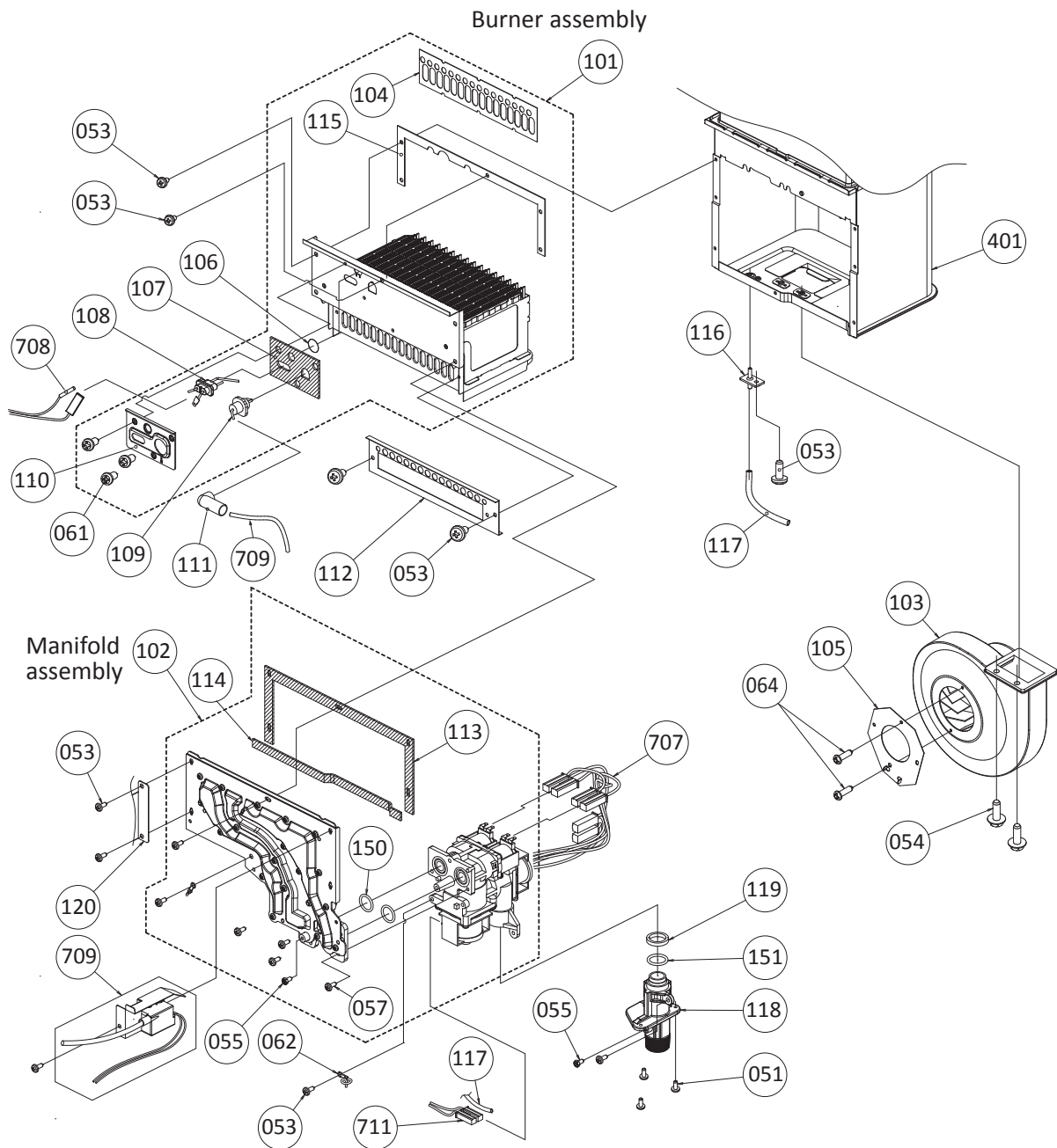
Computer board assembly



Surge box assembly



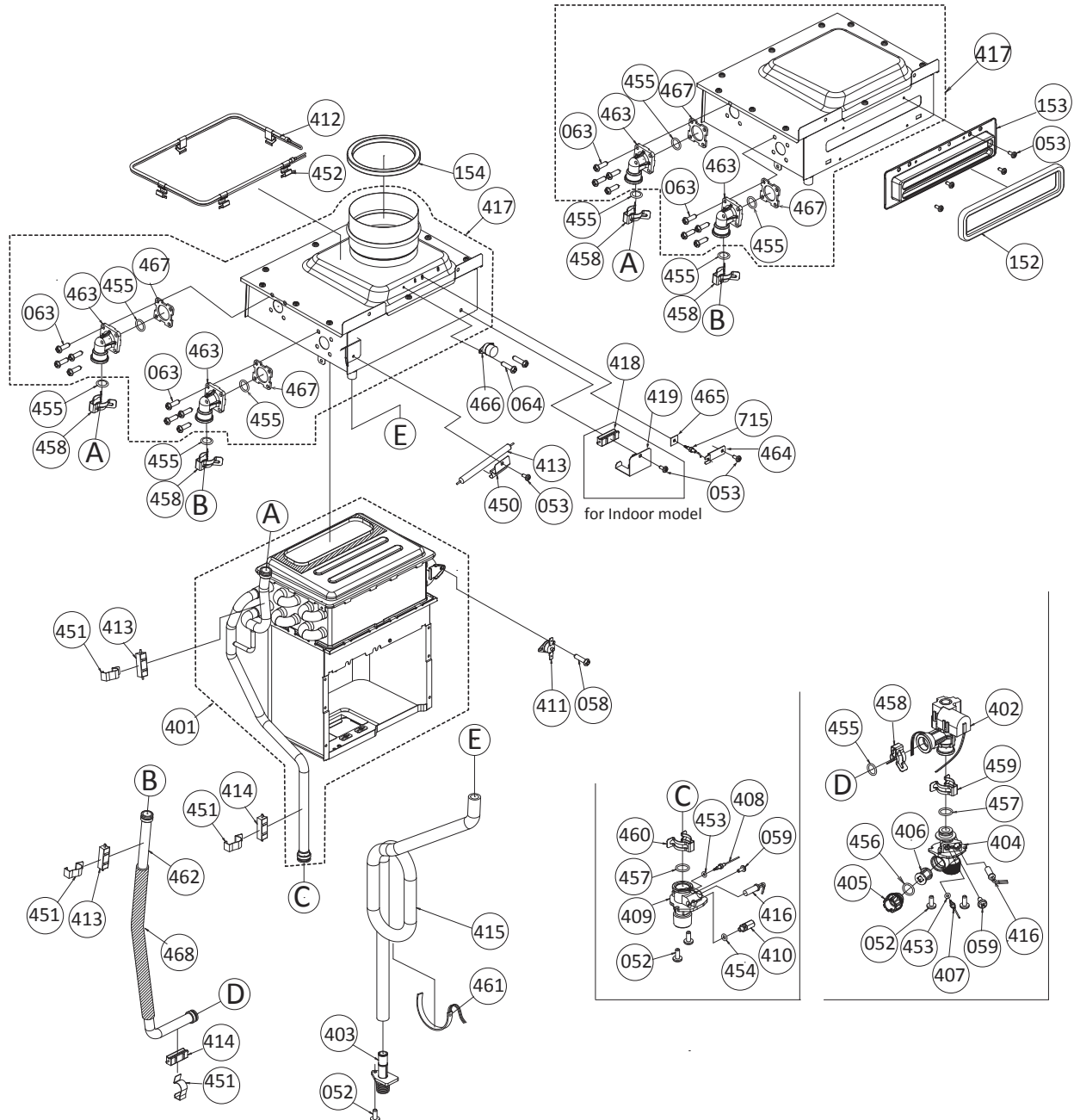
Burner assembly



Water Way assembly

Indoor Model

Outdoor Model



PARTS LIST

Item #	Description	Part #	
		140 model	T-H3M model
001	Case assembly for Indoor model	N/A	EK450
	Case assembly for Outdoor model	N/A	EK451
002	Front cover for Indoor	N/A	EK452
	Front cover for Outdoor	N/A	EK453
003	Intake air port assembly	100076311	EK454
004	Bracket	N/A	EK455
005	Junction box	100074668	EK190
006	Power supply cord assembly	100076313	EK456
007	Back guard panel	N/A	EK457
050	Truss screw M4×12 (W/Washer) SUS410	100074210	EW000
051	Truss screw M4×10 (W/Washer) SUS410	100074509	EW001
052	Truss screw M4×10 (Coated) SUS3	100074211	EW002
053	Truss screw M4x10 SUS	100074245	EW003
054	Hex head screw M4×12 (W/Washer) SUS3	100074510	EW004
055	Hex head screw M4x8 FEZN	100074248	EW005
056	Pan screw M4x20 SUS410	N/A	EW018
057	Tap tight screw M4x12 FEZN	100074385	EKK31
058	Tapping screw M3x6 SUS3 Pan head	100074272	EW00A
059	Tapping screw M4x6 SUS3 Truss head	100074512	EW009
060	Plus bind Screw M3x6 FEZN	N/A	EK191
061	Pan screw M4x8 MFZN	100074526	EW00D
062	Wire clamp 60	100074233	EM167
063	Truss tapping screw M4x10 (S coated)	N/A	EW00P
064	Screw M3x6 SUS3 Binding head	100074514	EW00B
101	Burner assembly	100076314	EK458
102	Manifold with gas valve assembly LP	100076315	EK459
	Manifold with gas valve assembly NA	100076317	EK460
103	Fan motor for Indoor model	100074606	EK109
	Fan motor for Outdoor model	100074228	EKK25
104	Burner gasket	100074216	EKK2X
105	Fan damper for Indoor model	100076511	EK491
	Fan damper for Outdoor model	100074466	EM381
106	Burner window	100074218	EKK2V
107	Rod holder gasket	100074219	EKK2W
108	Flame rod	100074673	EK193
109	Igniter rod	100076318	EK461
110	Rod holder	100074221	EKK32
111	Rod cap	100076319	EK462
112	Burner damper Indoor	100076320	EK463
	Burner damper Outdoor	100076321	EK464
113	Manifold gasket A	100074229	EKK2Y
114	Manifold gasket B	100074230	EKK2K
115	Burner holder gasket	100074217	EKK0G
116	Pressure port	100074227	EKK2D
117	Combustion chamber tube	100074528	EX019
118	Gas inlet	100076323	EK465
119	Gas inlet ring	100074234	EKK2Z
120	Surge box plate	N/A	EK466

Item #	Description	Part #	
		140 model	T-H3M model
150	O-ring P18 NBR (Black)	100074533	EZP18
151	O-ring P20 NBR (Black)	100074242	EK042
152	Silicon ring for Outdoor model	100074553	EK442
153	Exhaust port for Outdoor model	100074306	EX13J
154	Silicon ring	100074250	EKN50
401	Primary heat exchanger assembly for 140 Indoor and Outdoor	100076510	EK467
402	Flow adjustment valve / Flow sensor	100074624	EK129
403	Condensate drain port	100074203	EKH23
404	Water inlet	100074377	EKK1U
405	Inlet drain plug	100074381	EKK2B
406	Inlet water filter	100074382	EKK2C
407	Inlet thermistor	100074398	EKK4J
408	Outlet thermistor	100074680	EK207
409	Water outlet	100074627	EK104
410	Outlet drain plug	100074383	EKK2E
411	Hi-Limit switch	100074412	EM212
412	Overheat-cut-off fuse	100074252	EX02A
413	Pipe heater	100076325	EK468
414	Inlet heater	100076326	EK469
415	Drain tube	100076327	EK470
416	Inlet heater	100074629	EK105
417	Secondary heat exchanger for Indoor model	100076507	EK471
	Secondary heat exchanger for Outdoor model	100076508	EK472
418	Secondary heat exchanger heater	100076328	EK473
419	Heater fixing plate	N/A	EK474
450	Pipe heater fixing plate	N/A	EK475
451	Heater fixing plate 16	100074310	EK031
452	Fuse fixing plate	N/A	EK476
453	O-ring P4 FKM	100076303	EZF04
454	O-ring P6 FKM	100076305	EZF06
455	O-ring P14 FKM	100076306	EZF14
456	O-ring P15 FKM	100076307	EZF15
457	O-ring P16 FKM	100076308	EZF16
458	Fastener "14-22"	100074290	EKK24
459	Fastener "16A"	100074410	EM192
460	Fastener "16-25A"	100074389	EKK39
461	Flat heater	100074686	EK217
462	Cold pipe for 140 model	100076509	EK477
463	Header connection	100076329	EK478
464	Thermistor fixing plate	100074291	EX13H
465	Exhaust thermistor gasket	100074296	EX13L
466	Hi-limit switch for exhaust	100074289	EKH6G
467	Gasket	100074693	EK229
468	Inlet pipe packing	N/A	EK479

Item #	Description	Part #	
		140 model	T-H3M model
701	Computer board	100076330	EK480
702	Rubber grommet	N/A	EK148
703	Surge box	100076100	EK280
704	120 VAC wire for Indoor model	100074601	EK146
	120 VAC wire for Outdoor model	100074697	EK143
705	120 VAC Power ON-OFF switch	100074326	EKK4V
706	Remote controller wire for Indoor model	100076337	EK481
	Remote controller wire for Outdoor model	100074634	EK138
707	Gas valve wire	100076340	EK482
708	Flame rod wire	100076341	EK483
709	Igniter assembly	100076342	EK484
710	Freeze protection thermostat	100074369	EKJ59
711	Proportional gas valve wire	100074642	EK112
712	Nylon clamp FC6	N/A	EX004
713	Computer board cover	100074375	EKK1M
714	Cable clamp for Indoor model	N/A	EX13C
715	Exhaust thermistor for Indoor model	100074316	EKH6E
716	Exhaust Hi-limit switch wire	100074659	EK180
721	Temperature controller for Indoor model	100076567	EK487
722	Fixing plate	N/A	EK490
723	Temperature remote controller	100209924	TM-RE42
724	Remote controller connection wire	100076471	EK489

OUTPUT TEMPERATURE CHART

Chart is based on properly sized gas line

140 model

Output Temperature vs. GPM (Max. 7.0 GPM) with Various Inlet Water Temperature

