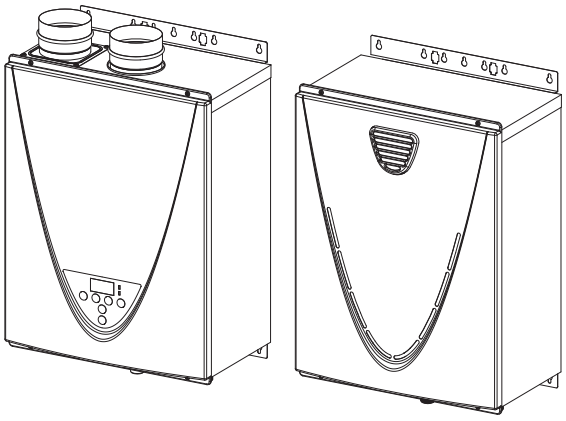
On-Demand Water Heater
Installation Manual and Owner's Guide

ANSI Z21.10.3 • CSA 4.3

Models

- **540P Indoor**
- **540P Outdoor**



Gas Tankless Water Heater™

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

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.

FEATURING

- INTEGRATED RECIRCULATION PUMP
- 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 NOx emissions of 14 ng/J or 20 ppm.
- EASY-LINK SYSTEM

If you have any questions, please call or write to

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

CANADA: 599 Hill Street West
Fergus, ON N1M 2X1
1-888-479-8324

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

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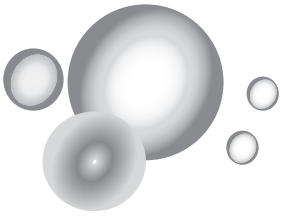


Installation Manual

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					540P Indoor	540P Outdoor
Natural Gas Input (Operating Range)				BTU/h	Min: 15,000 Max.: 199,000	
Propane Input (Operating Range)				BTU/h	Min: 13,000 Max.: 199,000	
Gas Connection					3/4" NPT	
Water Connections					3/4" NPT	
Water Pressure*				psi (MPa)	15 - 150 (0.1 - 1)	
Natural gas Inlet Pressure				" W.C. (kPa)	Min 4.0 (1.00) Max. 10.5 (2.61)	
Propane Inlet Pressure				" W.C. (kPa)	Min 8.0 (1.99) Max. 14.0 (3.48)	
Weight				lbs. (kg)	61.0 (27.7)	
Dimensions				inch	H 22.4 x W 17.7 x D 10.7	
				mm	H 570 x W 450 x D 272	
Ignition					Electric Ignition	
Electric	Supply			VAC / Hz	120 / 60	
	Consumption	Operation	With pump	W / A	108.6 / 1.34	
			Without pump	W / A	87.6 / 1.10	
		Standby		W / A	4.6 / 0.10	
		Freeze-Protection		W / A	192.3 / 1.63	
Water heater Category**					**Category IV**	N/A
Maximum Pipe length*** (Hot Water supply line and Dedicated Return line)				Pipe Diameter 3/4" (19 mm)	500 ft (152.4 m)	
				Pipe Diameter 1/2" (13 mm)	200 ft (61.0 m)	

*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.

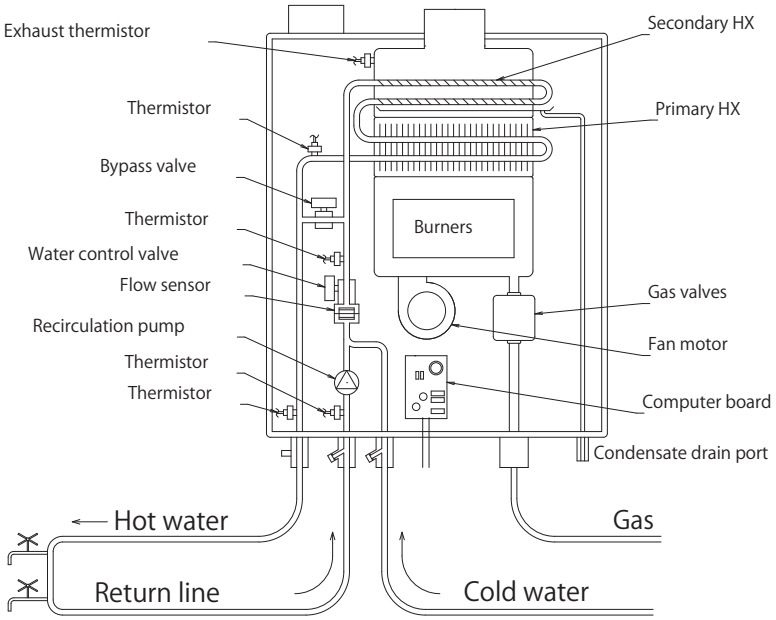
***These are equivalent lengths that include head loss for elbows, tees, unions, etc.

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 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 when properly sized and installed.
- This heater incorporates a recirculation pump for homes with an installed circulation system.
- These **high efficiency models** have a built-in secondary heat exchanger that absorbs latent heat from the exhaust gas.
- The 540P Indoor model is only to be installed indoors. The 540P Outdoor model is only to be installed outdoors.
- The 540P Indoor model is categorized as Category IV when it isn't installed in the direct vent installation.
- 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 tap is turned on.
2. Water enters the heater.
3. The water flow sensor detects the water flow.
4. The computer initiates the fan motor 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 circulates through the heat exchanger and then gets hot.
7. Using thermistors to measure temperatures throughout the water heater, the computer modulates the gas and water valves to ensure proper output water temperature.
8. When the tap is turned off, the unit shuts down.

SAFETY GUIDELINES

SAFETY DEFINITION

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

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

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

NOTICE 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 or the Gas Company or the manufacturer.

WARNING

- 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. 33 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. 61 for more information.
- Failure to observe these warnings could result in severe personal injury or death.

INCORPORATED RECIRCULATION PUMP

This heater incorporates a recirculation pump for homes with an installed circulation system. The pump provides several useful features:

- The built-in controller and the remote controller (100276687/TM-RE43) offer two timer settings for pump operation: PUMP TIMER 1 and PUMP TIMER 2. The pump will operate during the times set for TIMER 1 and/or TIMER 2.
- The pump automatically turns on and off during set times depending on the set temperatures for pump operation. The set point temperature can be set by the built-in controller or the remote controller (100276687/TM-RE43).
- Instead of the timers, the pump can operate by pressing the PUMP button on the built-in controller or the remote controller (100276687/TM-RE43). A DIP switch must be turned on to use this control. (Refer to p. 57.)

The maximum pipe length* for the combined hot water supply line and return line is:

- 1/2" (13 mm) pipe: 200 ft (61.0 m)
- 3/4" (19 mm) pipe: 500 ft (152.4 m)

*These are equivalent length that includes head loss for elbows, tees, unions, etc.

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 unit 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. The electrical connection requires a means of disconnection, to terminate power to the water heater 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 distance by local code from any doorway or opening to prevent exhaust from entering a building. (Refer to pp. 11, 28, and 29.)
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 540P Indoor is to be installed indoors only. This water heater is equipped with a thermistor and hi-limit switch for the exhaust gas, detecting excess temperatures within the flue and enabling the appliance to safely stop operation if needed. These components are always monitoring exhaust gas conditions in order to prevent heat damage to ABS, PVC, CPVC, or polypropylene (Plastic) venting. If the exhaust gas temperature exceeds 140 °F (60 °C), these components will enable the appliance 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 30 for more detail.
   - Terminating the venting through a sidewall is recommended for the direct-vent system.
   - Running the exhaust vent and the intake pipe parallel is recommended.
   - Terminating the exhaust and intake on the same wall/surface is recommended. 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 water heater must be securely mounted to a wall or other suitable structure.
10. The 540P Outdoor model is only to 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 for 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.**

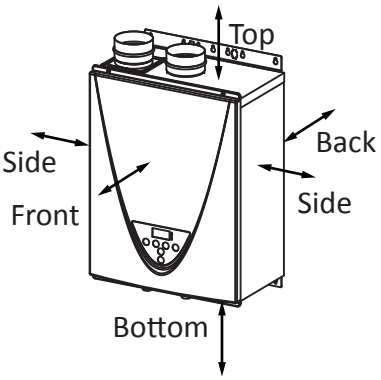
NOTICE

- **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.

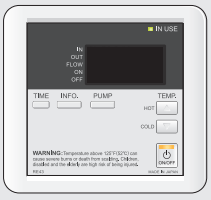
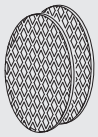


Model	Top	Bottom	Front	Back	Sides
540P Indoor*	12 in (305 mm)	12 in (305 mm)	4 in** (102 mm)	0.5 in (13 mm)	3 in (76 mm)
540P Outdoor	36 in (914 mm)	12 in (305 mm)	24 in (610 mm)	0.5 in (13 mm)	3 in (76 mm)

*Standard indoor installations and direct-vent indoor installations have the same clearances.
**24 inches recommended for maintenance.

INCLUDED ACCESSORIES

Check that these items below are included with the water heater.

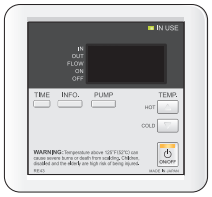
Installation manual and owner's guide	Temperature remote controller kit* Outdoor model only	Bird screen Indoor model only
Qty: 1	 **100276687 (TM-RE43)**	 Qty: 2

*Refer to pp. 10 and 38.

OPTIONAL ITEMS

#	Model	540P Indoor	540P Outdoor
1.	Temperature remote controller	✓	
2.	Pipe cover	✓	✓
3.	Neutralizer kit	✓	✓
4.	Sidewall vent terminator (Hood) and Wall thimble	✓	
5.	3" PVC concentric termination	✓	
6.	Non-return valve	✓	
7	PVC Adapter	✓	

1. Temperature remote controller: 100276687 (TM-RE43)



The temperature remote controller has the following features:

- Adjusts set water temperature
- Controls the pump operation
- Works as a diagnostic tool
- provides a concise error code whenever there is a problem with the unit.

Refer to pp. 50 to 59 for more information.
See the Troubleshooting Section (pp. 64 to 69) for information on possible error codes.

2. Pipe cover: 100112718 (TH-PC03)

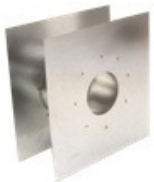
The pipe cover protects the plumbing pipes to the water heater from unexpected adjustments. This pipe cover is fixed to the bottom of the water heater, which hides the plumbing and improves the visual aspects of the whole installation for the water heater.

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. (Refer to pp. 35 and 36.)

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

They 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. (Refer to p.19.)

6. Non-return valve for common venting : 100113130

It is a must-have item for common venting system. It prevents the escape of combustion gas through non-operating appliances. (Refer to pp. 26 and 27.)

7. PVC Adapter: 100113129

This adapter transitions from the Non-return valve outlet to 4" schedule 40 PVC pipe.

WARNING FOR INSTALLATIONS

FOR YOUR SAFETY, READ BEFORE INSTALLATION:

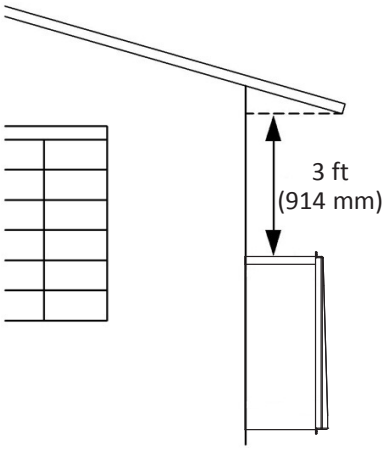
Do not install the heater where water, debris or flammable vapors may get into the flue terminal. This may cause damage to the heater and void the warranty.

Prohibited

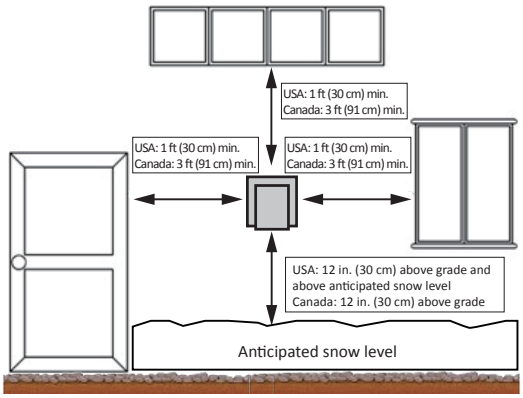
Do not have the vent terminal pointing toward any opening into a building. Do not locate your heater in a pit or location where gas and water can accumulate.

Prohibited

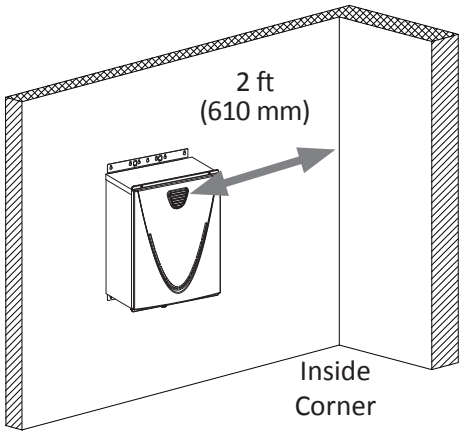
Do not install this water heater under an overhang less than 3 ft (914 mm) from its top or eaves. The area under an overhang must be open to three sides (Outdoor model only).



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.

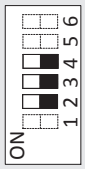
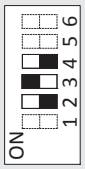
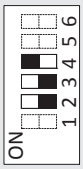
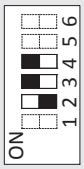
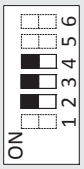
HIGH-ALTITUDE INSTALLATIONS

WARNING

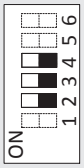
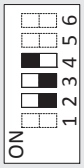
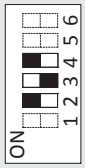
- **To adjust high altitude settings, adjust only the No. 2, No. 3, and No. 4 DIP switches in the MIDDLE bank of DIP switches. (See below.) DO NOT adjust the other DIP switches.**
- **Turn off the power supply to the water heater before changing the DIP switch settings.**
- **Failure to observe these 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

DIP switches \ 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)
Middle bank of DIP switches					
	No. 2 : OFF No. 3 : OFF No. 4 : OFF	No. 2 : OFF No. 3 : ON No. 4 : OFF	No. 2 : OFF No. 3 : OFF No. 4 : ON	No. 2 : OFF No. 3 : ON No. 4 : ON	No. 2 : ON No. 3 : ON No. 4 : ON

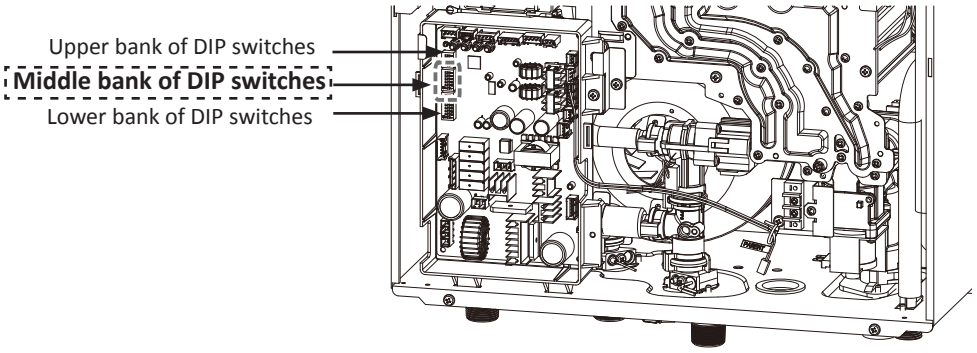
Outdoor model

DIP switches \ 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)
Middle bank of DIP switches			
	No. 2 : OFF No. 3 : OFF No. 4 : OFF	No. 2 : OFF No. 3 : OFF No. 4 : ON	No. 2 : ON No. 3 : OFF No. 4 : ON

Installation altitude

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

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



VENTING INSTRUCTIONS

540P 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 the section “Venting of Equipment" of 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 except an approved common-venting system. Refer to pp. 26 and 27.
- 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 lll / IV stainless steel. Regarding exhaust pipe, refer to pp.18 and 23.
- 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. 28 to 30.

-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, flourine, 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	199,000
Furnace	75,000
Dryer	20,000
Total	294,000

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.

Room Volume (ft^3) = Floor Area (ft^2) X 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.

Air Volume = Room Volume - 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 ft^3 (1.42 m^3) per 1,000 BTU/h of the total input for all gas burning appliances in the same area.

Required Air Volume (ft^3) =Total Appliance Energy Rating (btu/h) X 50 ft^3 / 1000 (btu/h)

Example:

(294,000 / 1000) x 50 = 14,700 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 in^2 (6.5 cm^2) . Not appropriate for confined spaces smaller than 50 ft^3 (1.42 m^3) 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 in^2 (645 cm^2) of free area would need 134 in^2 (865 cm^2) openings if using metal louvers rated at 75% free area (100 in^2 ÷ 0.75 = 134 in^2).
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 in^2 (645 cm^2).
- 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

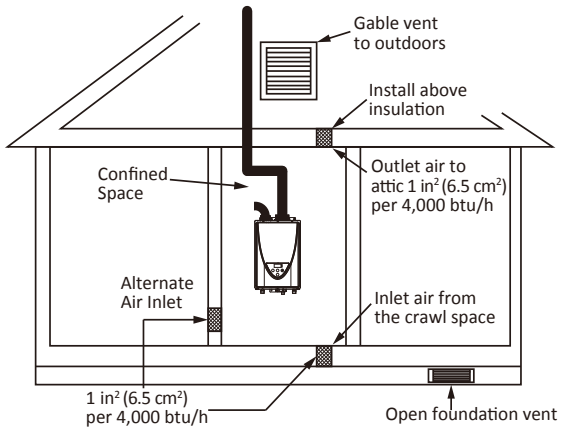


Figure 1 - Direct to outdoors openings

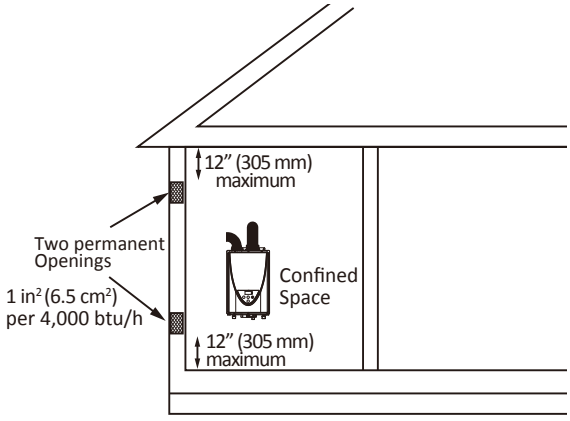


Figure 2 - Direct to outdoors openings
Two permanent openings

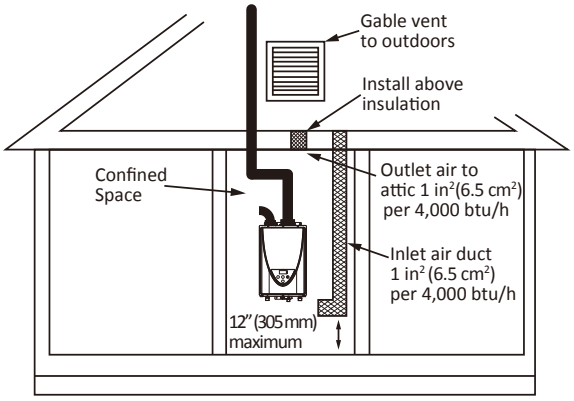


Figure 3 - Vertical duct openings

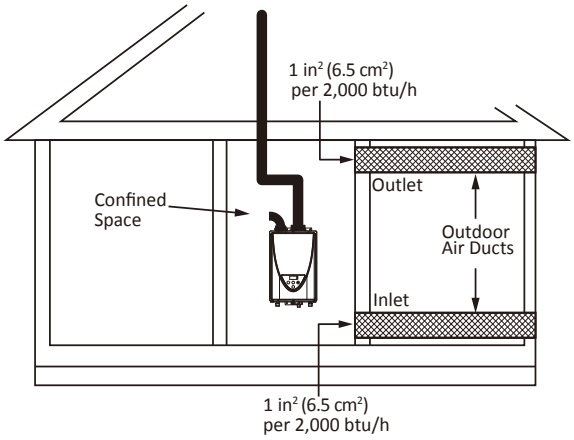


Figure 4 - Horizontal duct openings

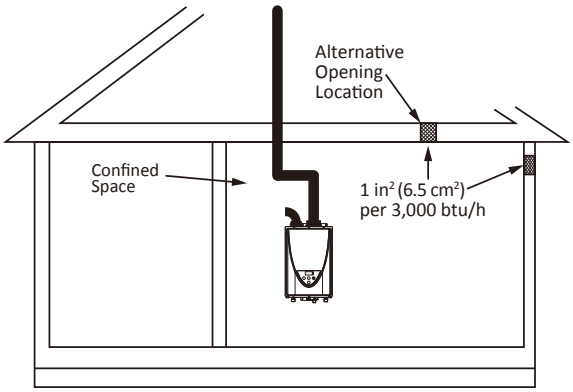


Figure 5 - SIngle opening

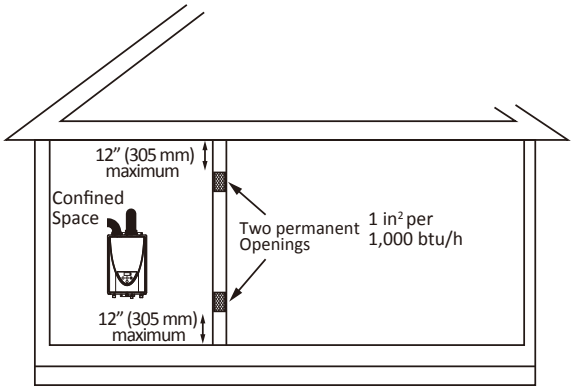


Figure 6 - Two permanent openings

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

The Indoor model can be vented with ABS, PVC, CPVC, or polypropylene (temperature rated up to 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" (76 mm) venting, which depends on the elevation where the water heater is installed, and 100 ft (30.5 m) for 4" (102 mm) 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.

Diameter	Max. No. of Elbows	Max. Vertical and Horizontal (Total) Vent Length
3 in (76 mm)	5	70 ft (21.3 m)
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 (Total) Vent Length			
	3" (76 mm) venting			4" (102 mm) venting
	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	70 ft (21.3 m)	40 ft (12.2 m)	25 ft (7.6 m)	100 ft (30.5 m)
1	65 ft (19.8 m)	35 ft (10.7 m)	20 ft (6.1 m)	95 ft (29.0 m)
2	60 ft (18.3 m)	30 ft (9.1 m)	15 ft (4.6 m)	90 ft (27.4 m)
3	55 ft (16.8 m)	25 ft (7.6 m)	10 ft (3.0 m)	85 ft (25.9 m)
4	50 ft (15.2 m)	20 ft (6.1 m)	N/A	80 ft (24.4 m)
5	45 ft (13.7 m)	N/A	N/A	75 ft (22.9 m)

Excludes vent terminators, termination elbows, or rain caps.

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

-DIP switch settings for vent length-

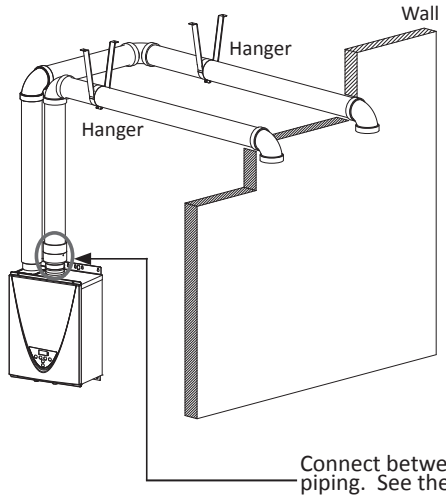
Typical installations using <u>PVC, CPVC, ABS, or polypropylene vent</u>

WARNING

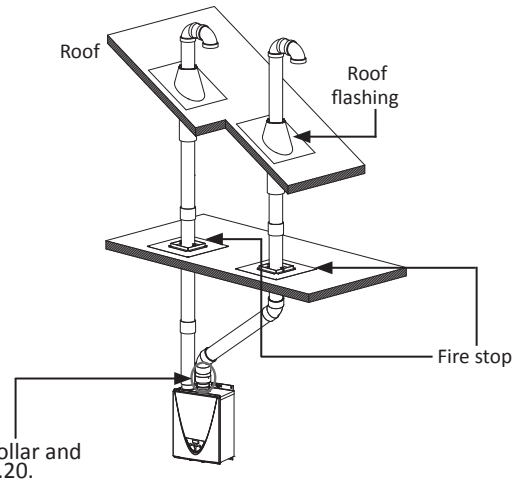
- **To adjust vent length, adjust only the No. 3 and No. 4 DIP switches in the LOWER bank of DIP switches. (See below.) DO NOT adjust the other DIP switches.**
- **Turn off the power supply to the water heater before changing the DIP switch settings.**
- **Failure to observe these warnings could lead to carbon monoxide poisoning or death.**

<Two-pipe, direct-vent installation>

Horizontal Installation

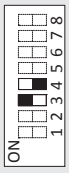
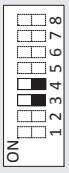
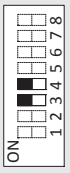
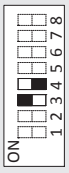
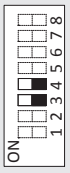


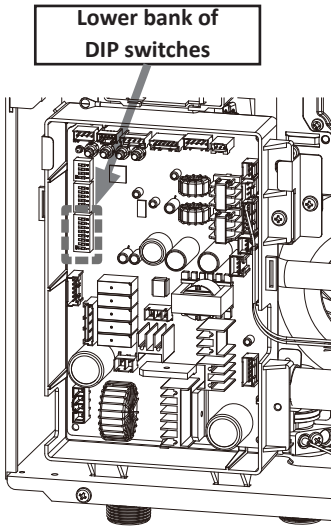
Vertical Installation



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

Set DIP switches shown in the table below depending on the vent diameter and length.

DIP switch settings : Two-pipe, Direct vent installations					
Vent diameter	3" (76 mm) venting*			4" (102 mm) venting	
Vent length / DIP switches	5 to 20 ft (1.5 to 6.1m) (DEFAULT)	21 to 40 ft (6.2 to 12.2 m)	41 to 70 ft (12.3 to 21.3 m)	5 to 50 ft (1.5 to 15.2m) (DEFAULT)	51 to 100 ft (15.3 to 30.5 m)
Lower bank of DIP switches					
	No. 3 : O N No. 4 : OFF	No. 3 : OFF No. 4 : OFF	No. 3 : O N No. 4 : O N	No. 3 : O N No. 4 : OFF	No. 3 : OFF No. 4 : OFF

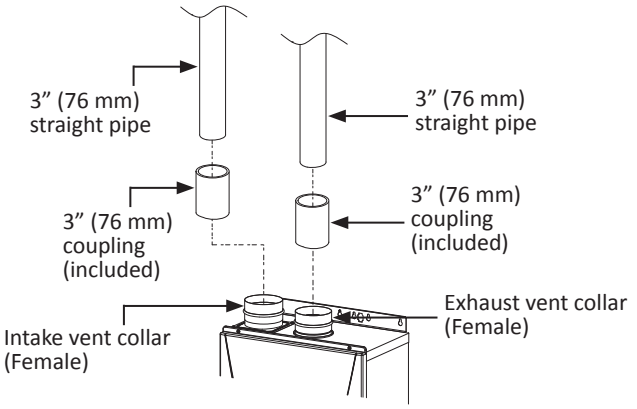


*__PVC concentric termination (100112163)__ installation is applied to the DIP switch settings of 3" (76 mm) venting. (Refer to p. 10.)

<How to install intake and exhaust venting (two-pipe, direct-vent) with the indoor model>

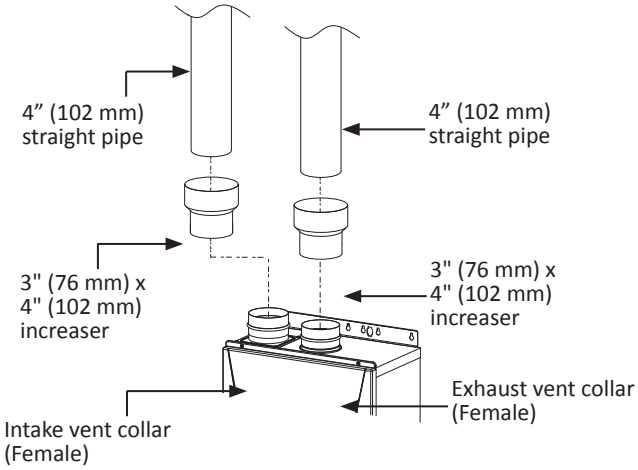
3" (76 mm) vent connection

1. Connect 3" (76 mm) couplings directly on the exhaust and intake vent collar of the water heater.
2. Connect 3" (76 mm) straight pipes to the couplings.



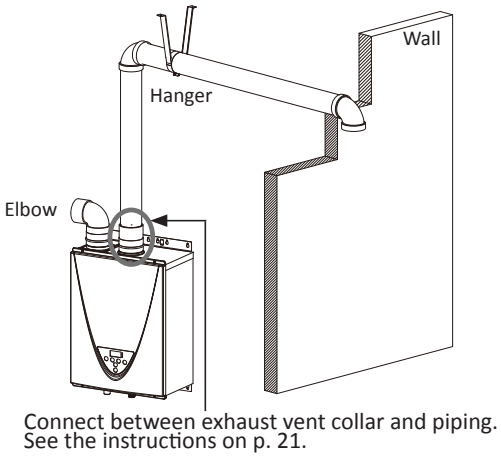
4" (102 mm) vent connection

1. Connect 3" x 4" (76 mm x 102 mm) increasers directly on the exhaust and intake vent collar of the water heater.
2. Connect 4” (102 mm) straight pipes to the increasers.

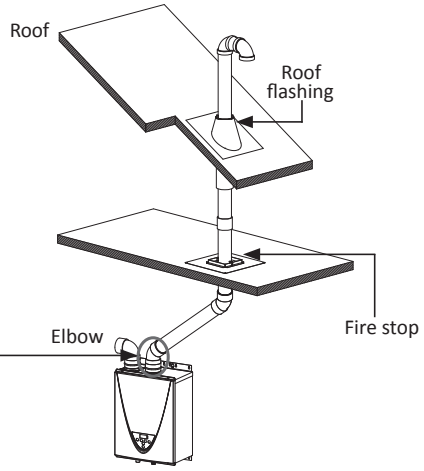


<Single pipe with room-air intake installation>

Horizontal Installation



Vertical Installation

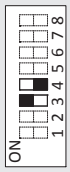
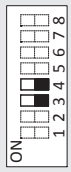
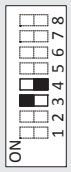
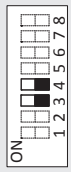


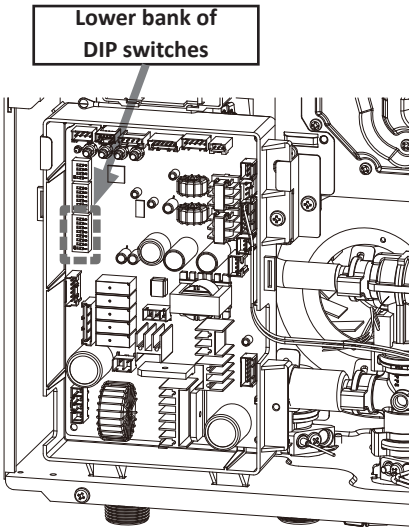
For details of the optional items, refer to the Installation manual for each Optional item.

WARNING

- **To adjust vent length, adjust only the No. 3 and No. 4 DIP switches in the LOWER bank of DIP switches. (See 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.**

Set DIP switches shown in the table below depending on the vent diameter and length.

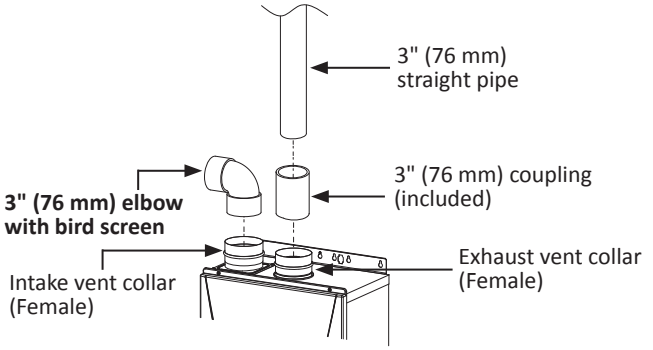
DIP switch settings : Single vent pipe installations				
Vent diameter	3" (76 mm) venting		4" (102 mm) venting	
Vent length / DIP switches	5 to 45 ft (1.5 to 13.7 m) (DEFAULT)	46 to 70 ft (13.8 to 21.3 m)	5 to 50 ft (1.5 to 15.2m) (DEFAULT)	51 to 100 ft (15.3 to 30.5 m)
Lower bank of DIP switches				
	No. 3 : O N No. 4 : OFF	No. 3 : OFF No. 4 : OFF	No. 3 : O N No. 4 : OFF	No. 3 : OFF No. 4 : OFF



<How to install single vent with the indoor model>

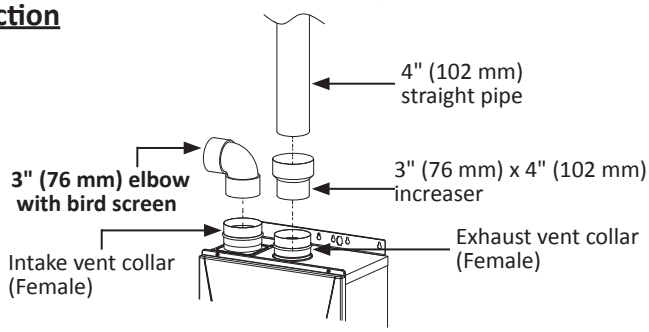
3" (76 mm) vent connection

1. Connect a 3" (76 mm) elbow directly on the intake vent collar of the water heater.
2. Connect a 3" (76 mm) coupling directly on the exhaust vent collar of the water heater.
3. Connect a 3" (76 mm) straight pipe to the coupling.



From 3" (76 mm) to 4" (102 mm) vent connection

1. Connect a 3" (76 mm) elbow directly on the intake vent collar of the water heater.
2. Connect a 3" x 4" (76 mm x 102 mm) increaser directly on the exhaust vent collar of the water heater.
3. Connect a 4" (102 mm) straight pipe to the increaser.



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 (71 °C). 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" (106 mm) vent approved for use with Category III/IV or Special BH type gas vent.
- **The manufacturer recommends the NovaVent 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.**

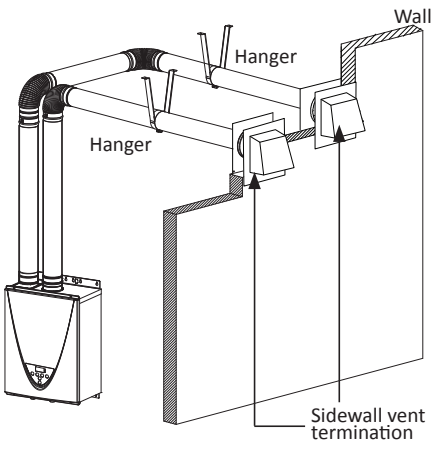
No. of Elbows	Max. Vertical or Horizontal Vent Length
0	100 ft (30.5 m)
1	95 ft (29.0 m)
2	90 ft (27.4 m)
3	85 ft (25.9 m)
4	80 ft (24.4 m)
5	75 ft (22.9 m)

Excludes vent terminators, termination elbows, or rain caps.

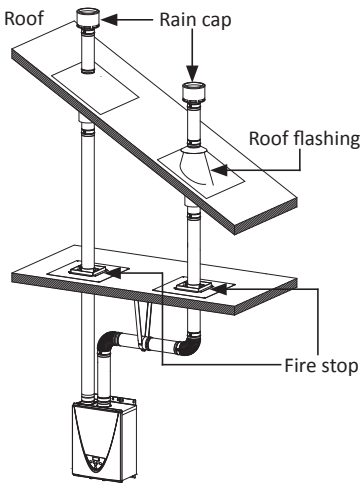
-DIP switch settings for vent length-

Typical installations using <u>stainless steel vents</u>

Horizontal Installation



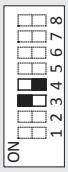
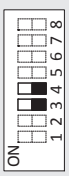
Vertical Installation

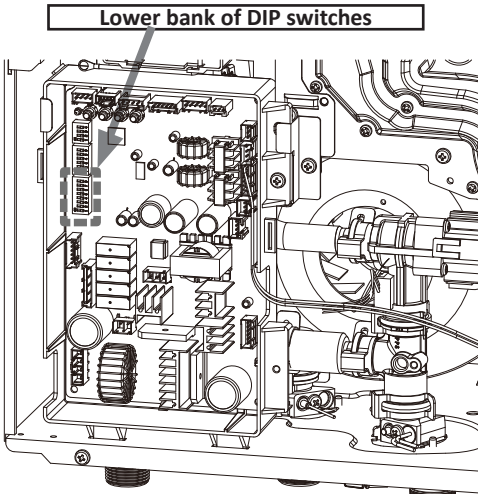


WARNING

- **To adjust vent length, adjust only the No. 3 and No. 4 DIP switches in the LOWER bank of DIP switches. (See 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.**

Set DIP switches shown in the table below depending on the vent diameter and length.

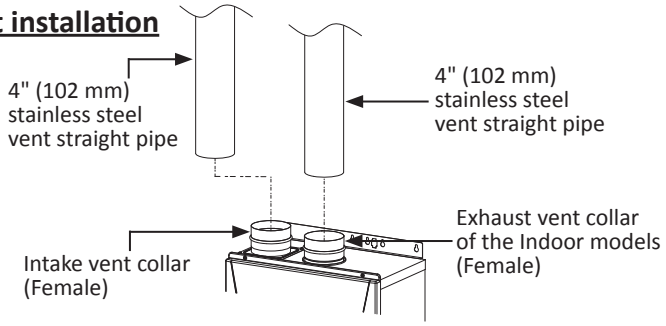
DIP switch settings : Single pipe and Direct vent installations		
Vent diameter	4" (102 mm) venting	
Vent length / DIP switches	5 to 50 ft (1.5 to 15.2m) (DEFAULT)	51 to 100 ft (15.3 to 30.5 m)
Lower bank of DIP switches	 No. 3 : O N No. 4 : OFF	 No. 3 : OFF No. 4 : OFF



<How to install stainless steel vent with the indoor model>

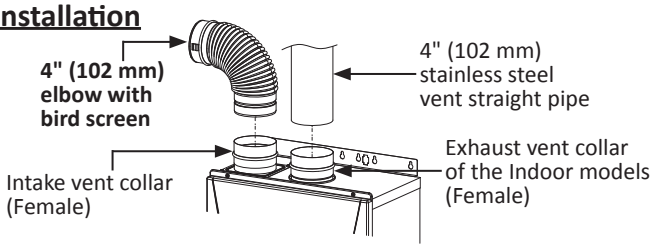
4" (102 mm) vent connection for direct-vent installation

1. Connect 4" (102 mm) stainless steel vent straight pipes directly on the exhaust/ intake vent collar of the water heater.



4" (102 mm) vent connection for single vent installation

1. Connect a 4" (102 mm) stainless steel vent straight pipes directly on the exhaust vent collar of the water heater.
2. Connect a 4" (102 mm) elbow directly on the intake vent collar of the water heater.



WARNING

- Regarding the clearances from the exhaust terminal to the air inlet or opening, refer to pp. 28 to 30.
- 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

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

-Common-venting system-

The Indoor model can be vented together using the same exhaust and intake venting.

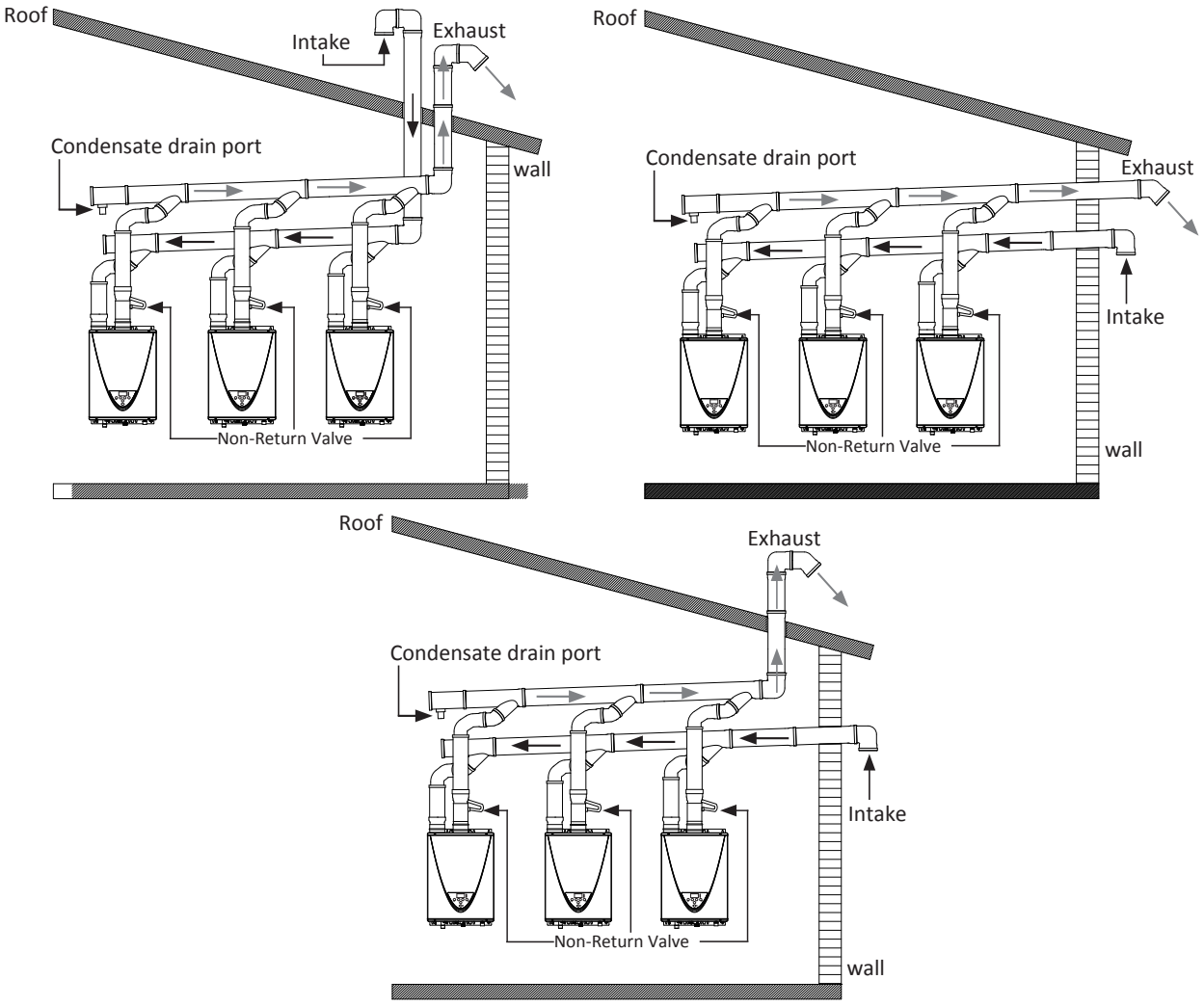
- Up to 8 water heaters can be common-vented together.
- A non-return valve (100113130) must be used for each water heater that is part of the system.
- The water heaters must all be direct-vented.
- The common-venting system shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or B149.1, Natural Gas and Propane Installation Code (Current Editions), local codes, and the following manufacturer's instructions.
- For common-venting pieces and components, the manufacturer recommends Centrotherm's vent line.

Allowable models for common-venting
240 Indoor, 340 Indoor, 540 Indoor, 540P Indoor

CAUTION

Only the above allowable models can be common-vented together. Different models cannot be common-vented.

Typical common-vent installation examples

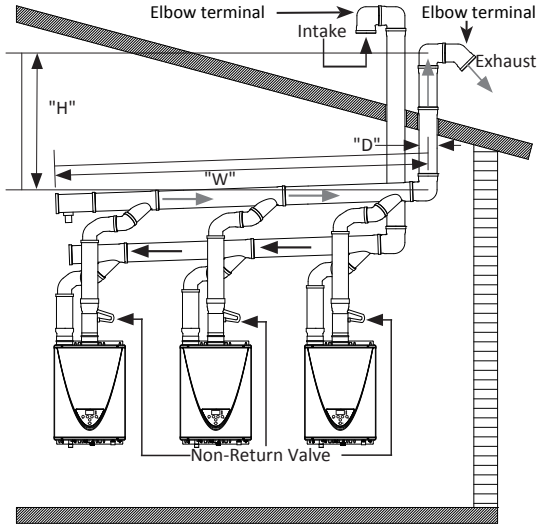


NOTICE For details on the installation of a common-vent system, please refer to "Common Venting Tankless Gas Water Heaters." It is a manual which is available on the water heater manufacturer's website.

To determine the dimension of a common-venting system

Determine the vent diameter (D) and the total vent length based on the number of water heaters installed. The total vent length (L) consists of the horizontal width (W) and the vertical height (H). See the table below.

- **Total vent length (L)="H"+"W"**
- **Vent diameter="D"**

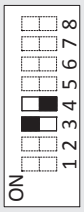


NOTICE

- Regarding the clearances between the exhaust termination and the intake termination, refer to pp. 28 to 30.
- Insert bird screen in elbow terminals.

WARNING

- **A Non-Return Valve must be installed for each water heater.** This prevents the escape of combustion gas through non-operating appliances.
- For detailed instructions on the common-venting system, refer to the instructions that are packaged with the vent parts or web site.

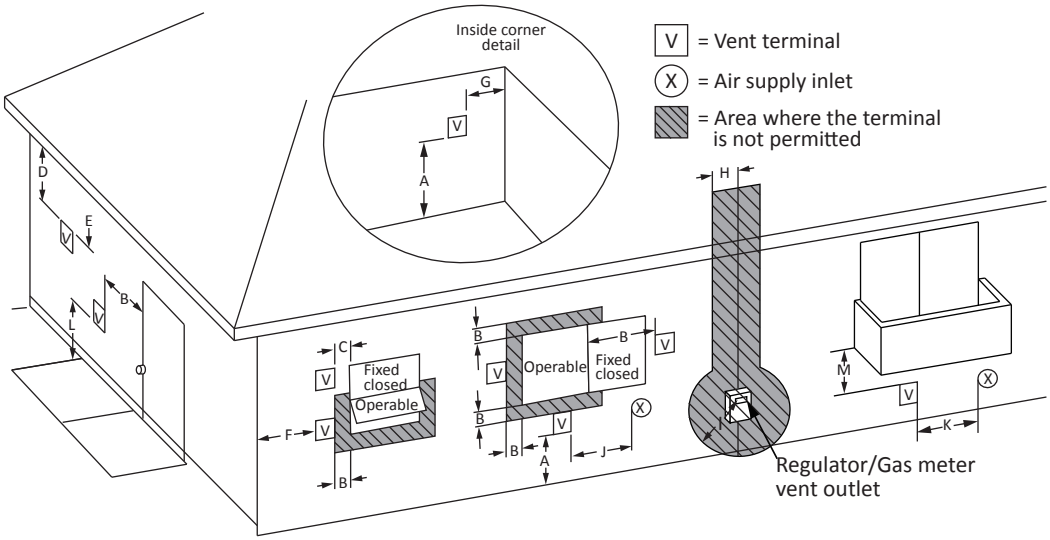
Common-venting system			
Vent Diameter* (D)	Max. No.of water heaters	Max. Vertical and Horizontal (Total) Vent Length** (L)	DIP switch settings 540P Indoor (Lower bank of DIP switches)
4 in (110 mm)	2	25 ft (7.6 m)	 No.3 : ON No.4: OFF
5 in (125 mm)	2	50 ft (15.2 m)	
	3	20 ft (6.1 m)	
6 in (160 mm)	2	100 ft (30.5 m)	
	3	75 ft (22.9 m)	
	4	50 ft (15.2 m	
	5	25 ft (7.6 m)	
	6	20 ft (6.1 m)	
8 in (200 mm)	3	100 ft (30.5 m)	
	4	100 ft (30.5 m)	
	5	85 ft (25.9 m)	
	6	65 ft (19.8 m)	
	7	50 ft (15.2 m)	
	8	41 ft (12.5 m)	
10 in (250 mm)	5	100 ft (30.5 m)	
	6	100 ft (30.5 m)	
	7	100 ft (30.5 m)	
	8	100 ft (30.5 m)	

WARNING

- **For common-venting, adjust only the No.3 and No.4 DIP switches in the LOWER bank of DIP switches. (Refer to p.24 for the location of the 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.**

*Diameters of pipes are in accordance with Centrotherm's specifications.
**One elbow is equivalent to 5 ft (1.5 m) linear length, and the maximum number of elbows is 5.

-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:

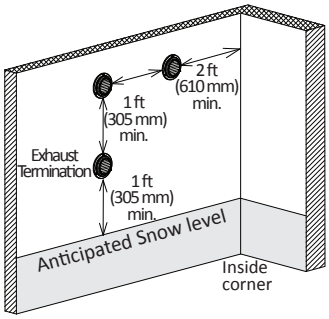
1) over public walkways; or
2) near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage; or
3) where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

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

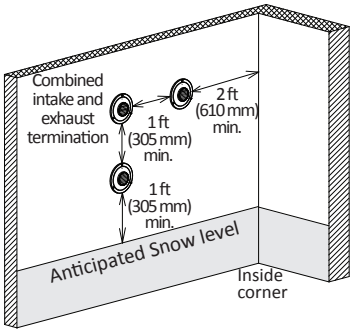
-Clearances for sidewall terminations-

WARNING 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

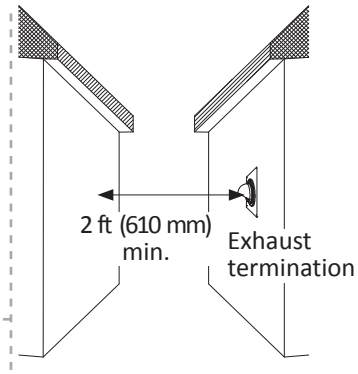
An exhaust termination must be at least 1 ft (305mm) away from another exhaust termination. An exhaust termination must also be at least 2 ft (610 mm) away from an inside corner. (If the adjacent wall is less than 2 ft (610 mm) of length, the minimum required distance away from the inside corner will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

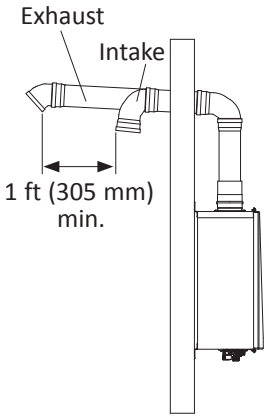
A direct vent termination must also be at least 2 ft (610 mm) away from an inside corner. (If the adjacent wall is less than 2 ft (610 mm) of length, the minimum required distance away from the inside corner will be equal to the length of that adjacent wall.)

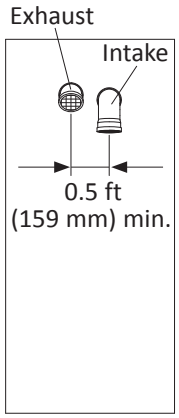


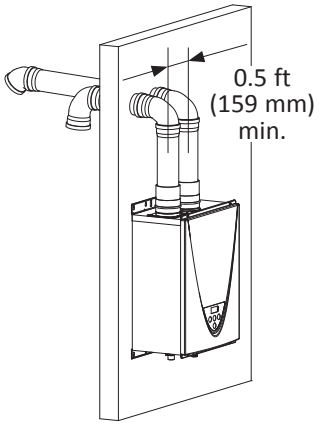
Exhaust and/or direct vent sidewall terminations should be at least 2 ft (610 mm) away from an opposite surface/wall. Do not place the termination directly in front of an opening into a building.

<Case 1>

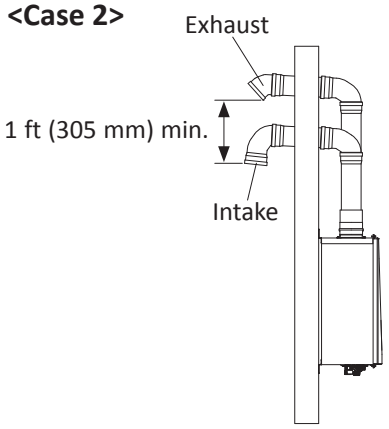
For direct vent sidewall terminations that use two separate penetrations for the intake and exhaust, keep the termination clearances shown in the diagrams on the right.

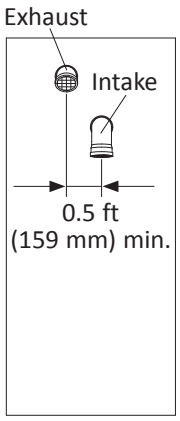


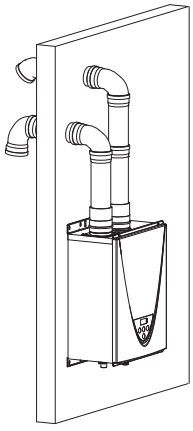




<Case 2>







-Clearances for rooftop terminations-

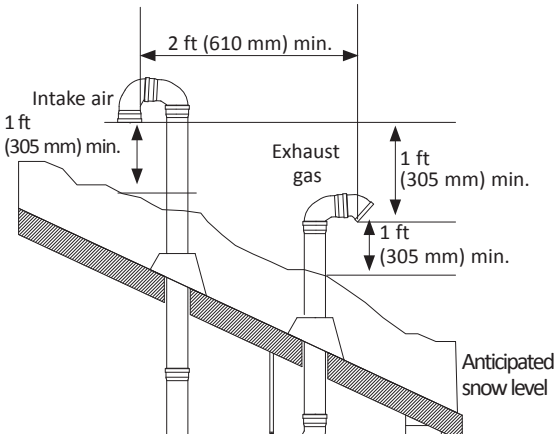
WARNING

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.

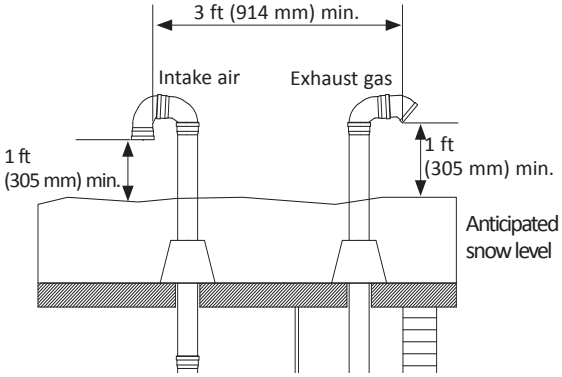
NOTICE

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.

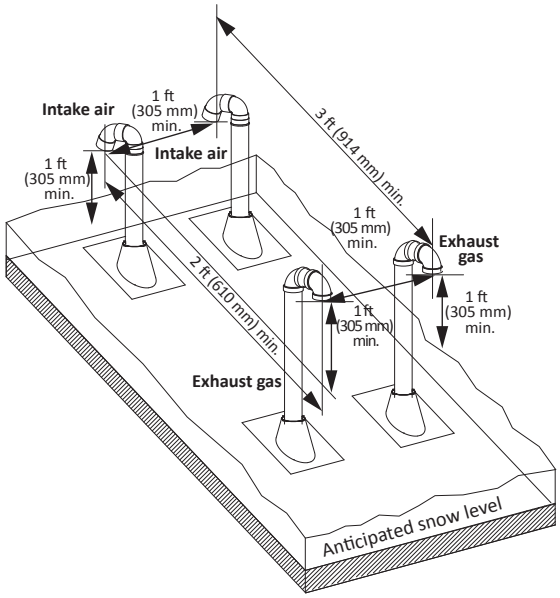
Angled roof termination



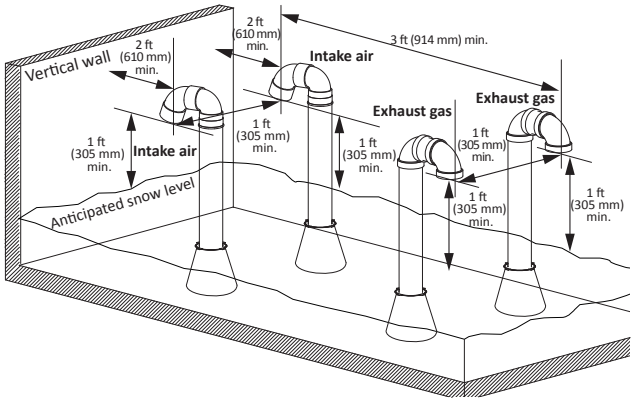
Flat roof termination



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

- **Check that the type of gas matches the rating plate first.**
- **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.
- 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 199 Cubic ft/hr for the 540P 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

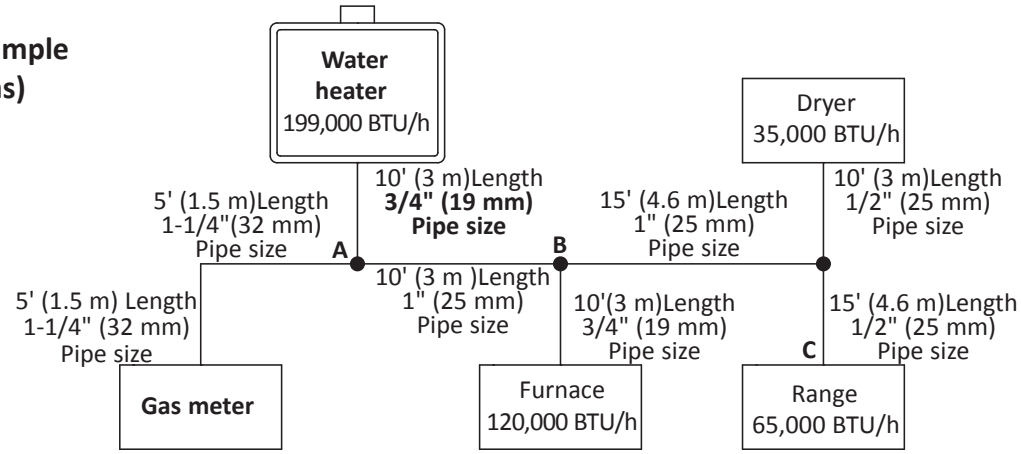
-Propane (LP) supply piping-

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

Gas sizing example (Natural Gas)



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

Divide each appliance's BTU/h requirement by 1,000 BTU/ft^3 to get the appliance's ft^3/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

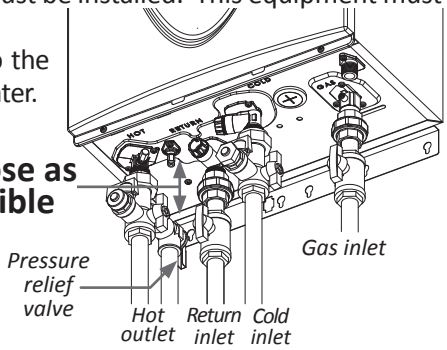
Do not use this appliance if any part has been under water. Immediately contact a qualified installer or service agency to replace a flooded water heater. Do not attempt to repair the unit! It must be replaced!

NOTICE

Do not reverse the hot outlet and cold inlet connections to the water heater. If you reverse the connections, the water heater will not activate properly.

All pipes, pipe fittings, valves and other components, including soldering materials, must be suitable for potable water systems. Also, an automatic air vent or air separator must be installed. This equipment must be installed according to its manufacturer's instructions.

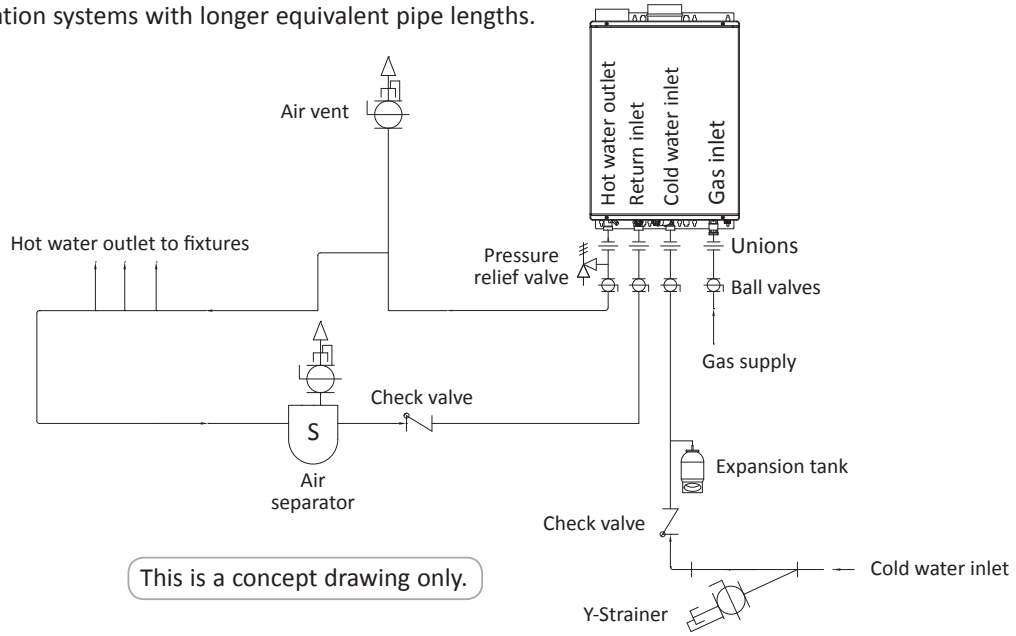
1. A manual shutoff valve must be installed on the cold water inlet to the water heater between the main water supply line and the water heater.
2. In addition, a manual shutoff valve is also recommended on the hot water outlet and return inlet of the unit. A thermal expansion tank or code approved device to handle thermal expansion must be installed.
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 and return inlet to trap debris from entering your heater. This will need to be cleaned periodically to maintain optimum flow. (Refer to p. 63.)



-Installation with dedicated return line-

Model			540P Indoor	540P Outdoor
Maximum Pipe length* (Hot Water supply line and Dedicated Return line)	Pipe Diameter	3/4" (19 mm)	500 ft (152.4 m)	
		1/2" (13 mm)	200 ft (61.0 m)	

*These are equivalent length that includes head loss for elbows, tees, unions, etc. An additional pump may be necessary for circulation systems with longer equivalent pipe lengths.



This is a concept drawing only.

NOTICE

- **Check valves must be installed on both of the cold water line and return line. Please refer to the above diagram.**
- **Insulate the hot water supply line and dedicated return line to prevent heat loss.**

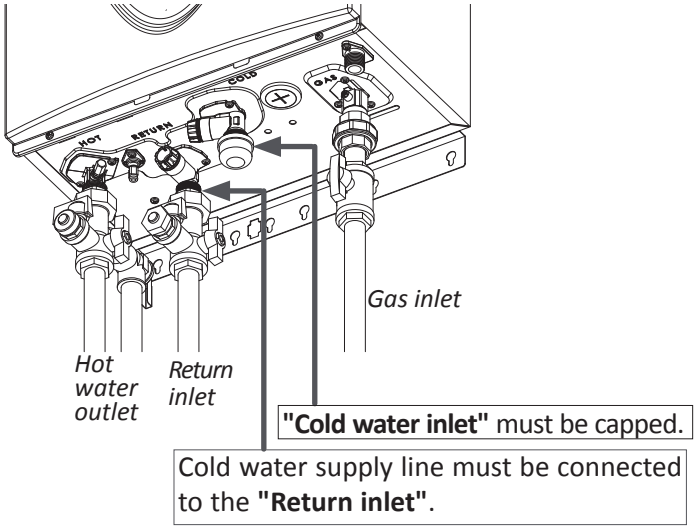
-Installation without dedicated return line-

NOTICE

- **Cold water supply line must be connected to the "Return inlet".**
- **The "Cold water inlet" must be capped.**

This piping installation is used when the heater is installed in a system without a dedicated return line.

- Install the water supply line to the **"Return inlet"** water connection.
- Install a 3/4" end cap to the **"Cold water inlet"** connection.



-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 199,000 BTU/h for the 540P 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

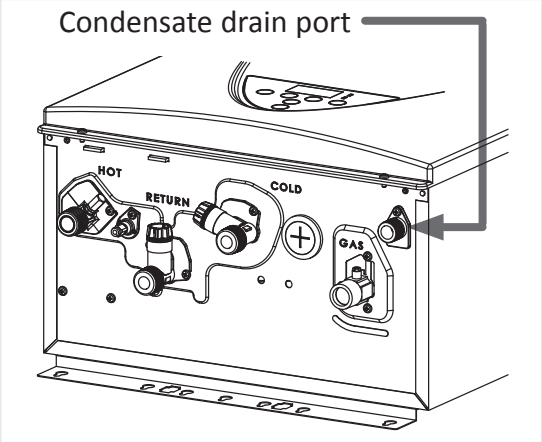
Hot water could be released. Before operating the pressure relief valve manually, check that it will discharge in a safe place. If water does not flow freely from the end of the discharge pipe, turn the gas supply and power OFF and call a qualified person to determine the cause.
Refer to the pressure 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 on condensate neutralizers and whether or not they are required for the installation.



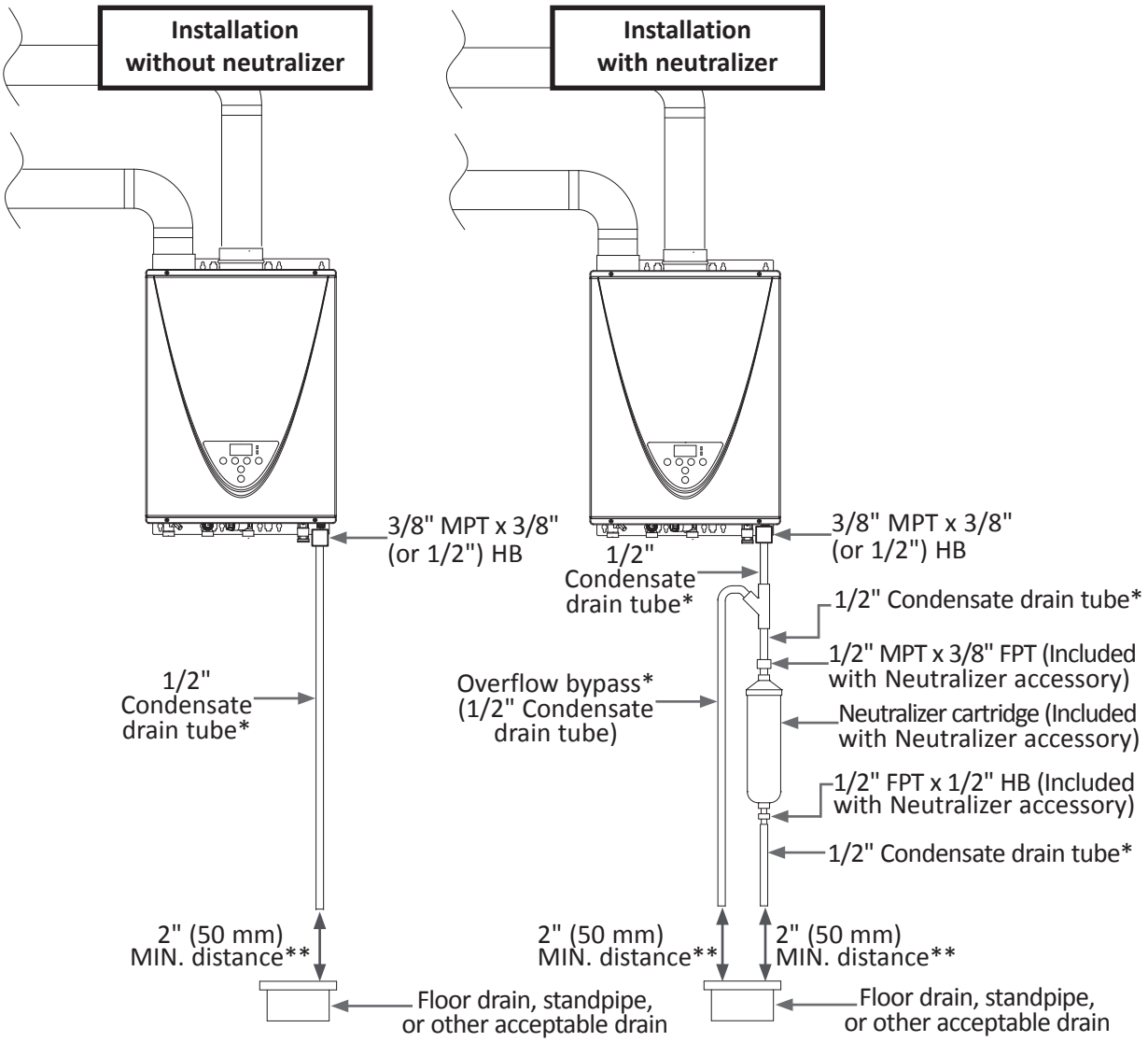
-Condensate drain connections-

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.



*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

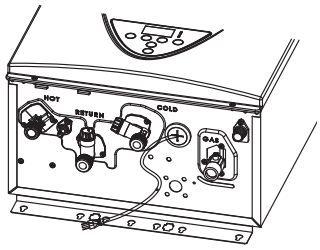
WARNING

- 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 death.

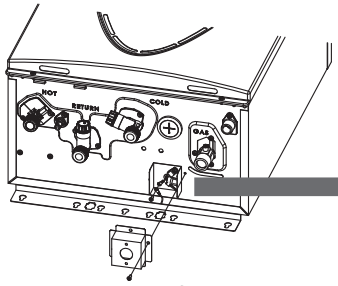
Indoor model comes with a power plug instead of a junction box. The following procedure is for outdoor model only.

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. The water heater can be hardwired or wired to a plug-in.
5. The use of a surge protector is recommended in order to protect the unit from power surges.

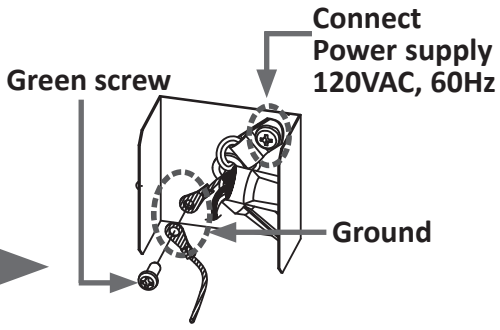
Indoor model



Outdoor model



Bottom view of water heater



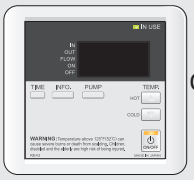
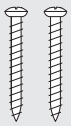
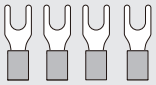
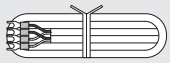
View of electrical connections of water heater

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 models.

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

It is also an optional accessory as a second remote for the indoor model. Refer to pp. 9 and 10.
***The optional remote controller (100276687/TM-RE43) has no remote controller cable.**

-Installation-

WARNING

- **<u>This remote controller is NOT waterproof.</u>**
- **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 the **Frame** off of the remote controller with a flat head screwdriver. (**Fig. A and B**)
2. Attach the **Metal plate** on the wall with two provided screws. (**Fig. B**)
3. If you use another cable, crimp the **Fork terminals** to the wires. (**Fig. C**)

Fig. A

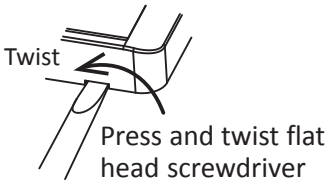


Fig. B

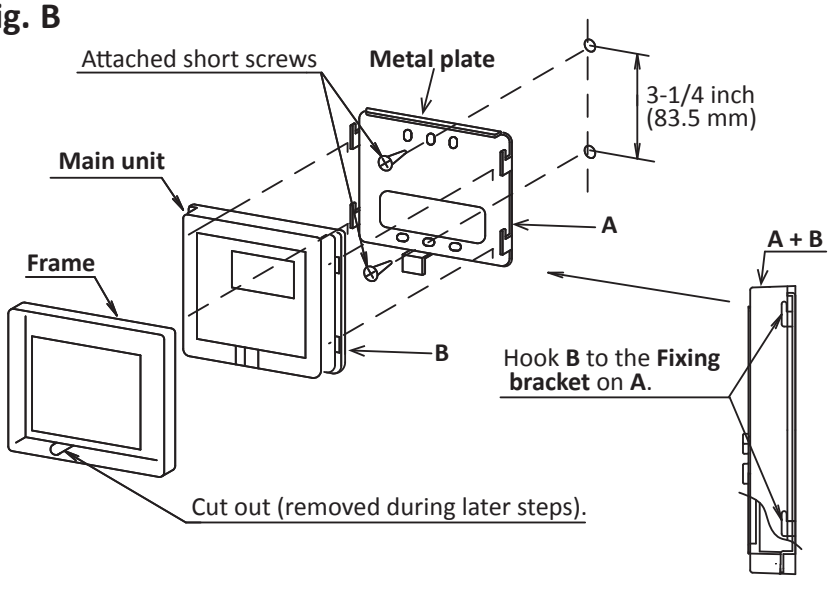
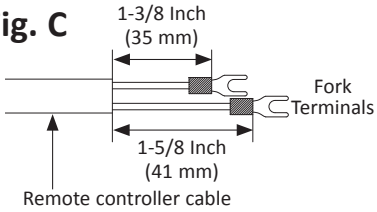


Fig. C



4. Open the **Plastic cover** and tighten the two **Fork terminals** beneath the two **Remote controller terminal** screws on the back of the **Main unit** (**Fig. D-1**). Cut out the inlet for the cable from the bottom of the main unit (**Fig. D-2**). Insert the cable through the inlet.
5. Close the **Plastic cover** and then hook the **Main unit** to the **Fixing bracket** on the **Metal plate**. (**Fig. B**)
6. Attach the **Frame** back onto the remote.

Fig. D-1

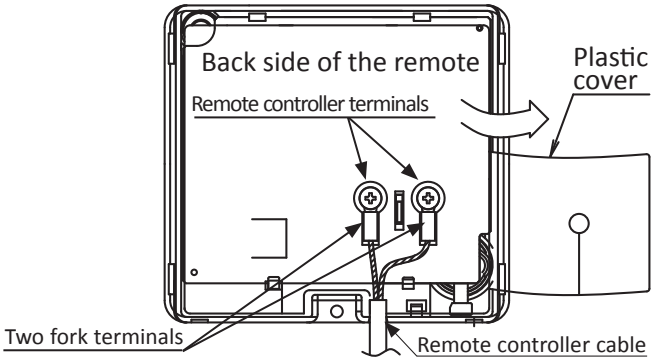
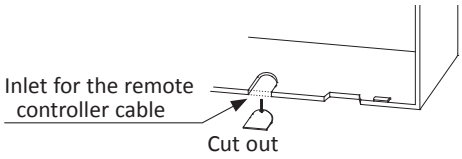


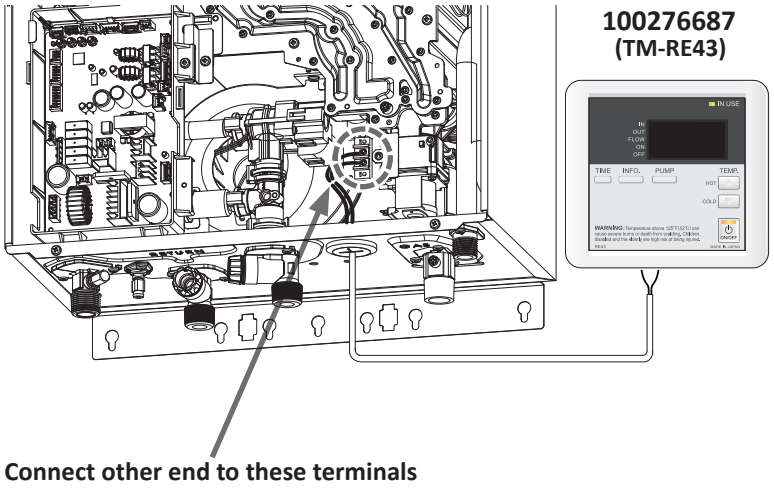
Fig. D-2



<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 remote controller terminals. See the diagrams below.
4. Take off the back plate from the remote controller, and then attach the two fork terminals to connector base on the backside 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. Properly attach the remote controller cable to the remote controller terminal on the computer board (No polarity). *** Do NOT jump or short-circuit the cable, or the computer will be damaged.**
7. Replace the front cover securely.

540P model

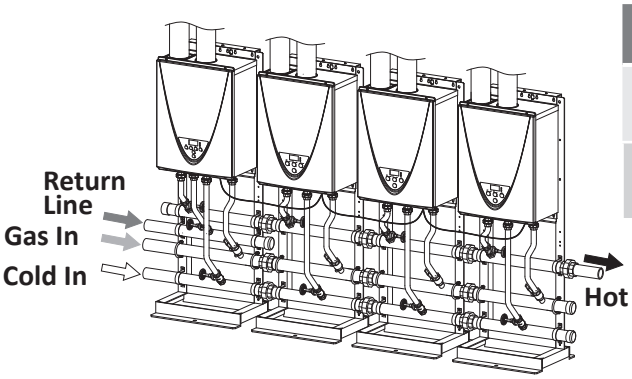


EASY-LINK SYSTEM

The 540P model water heater can be connected to 540 models as only a **PARENT** unit in an Easy-Link System.

- The built-in Easy-Link System allows up to 4 units to manifold together.
- Only one 540P can be installed in an Easy-Link System.
- A communication cable (gray color) comes with each 540 model.

You can manifold from 2 to 4 units. A 4-unit system has full automatic modulation between 13,000 BTU/h (Propane) or 15,000 BTU/h (Natural gas)to 796,000 BTU/h.



Type of unit	Model	Allocated No. from controller
PARENT	540P	1
CHILD-1/2/3	540	2,3,4*

*Each CHILD unit is allocated the above number from controller, which indicates on the display of the controller on the unit. (Refer to p. 65.)

NOTICE

- The Easy-Link System is limited to up to **4 units**. If you connect more than 4 units, only the first 4 units will work as a part of the Easy-Link System. The other additional units will not work.
- In the Easy-Link System, one unit must be designated as a PARENT unit by changing one of its DIP switch settings. The other units are CHILD units. The 540P model must be a PARENT unit and cannot be a CHILD unit. (The 540 model can be either a PARENT unit or a CHILD unit.)
- **A 540P model only can be connected to 540 models when 540P is a PARENT unit in the system.**
- A remote controller is not required for an Easy-Link System. However, it does provide for more temperature options and ease of maintenance.
- If a remote controller is used, the temperature on all the units in the system will automatically be set to the same temperature that is set on the remote.
- When a remote is used in an Easy-Link System, it must be connected to the parent unit.
- Only one remote can be connected.

-Easy-Link connection procedures for 540P & 540 models-

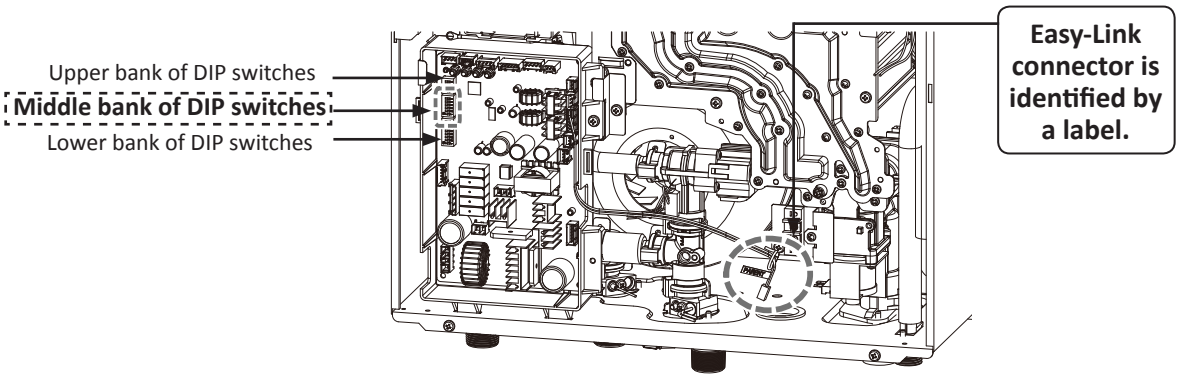
1. Make sure the power to the heaters are off.
2. Verify the DIP switch set temperatures of all units within the system. Every single water heater must be set to the same set temperature. If a remote controller is used, it should be installed to the **"PARENT"** unit. The remote will set the temperature for the entire system. When the 540P model is the **"PARENT"** unit, the only controller that can be used is the **100276687 (TM-RE43)**.
3. Select 540P unit to be the **"PARENT"** unit. The **"PARENT"** unit should be one of the end units.
4. **"PARENT"** unit:
   On the 540P that you select to be the **"PARENT"** unit, locate the three banks of DIP switches at the upper left of the computer board. Change **DIP switch No. 1** on the **middle bank of DIP switches to the ON position**. See the computer board diagram as shown on the next page. Do not change any DIP switches on any of the **"CHILD"** units.

5. Between the **"PARENT"** and the **"CHILD-1"** units:
   Connect the **"PARENT"** connector of the **"PARENT"** unit to the **"1"** connector of the **"CHILD-1"** unit using the supplied linking cable.
6. Between the **"CHILD-1"** and the **"CHILD-2"** units:
   Connect the **"2"** connector of the **"CHILD-1"** unit to the **"1"** connector of the **"CHILD-2"** unit.
7. Between the **"CHILD-2"** and the **"CHILD-3"** units:
   Connect the **"2"** connector of the **"CHILD-2"** unit to the **"1"** connector of the **"CHILD-3"** unit.
8. Verify that all cables are connected like the diagram on the next page (B).
9. Turn on power to the **"PARENT"** unit.
   Turn on **"CHILD-1"**. When the (remote and/or built-in) controller displays a number, turn on **"CHILD-2"**.
   When the (remote and/or temperature) controller displays a number, turn on **"CHILD-3"**.
   Make sure the (remote and/or temperature) controller display the unit #. The numbering system automatically allocates the unit # to each water heater in the Easy-Link System, in accordance with the table above.

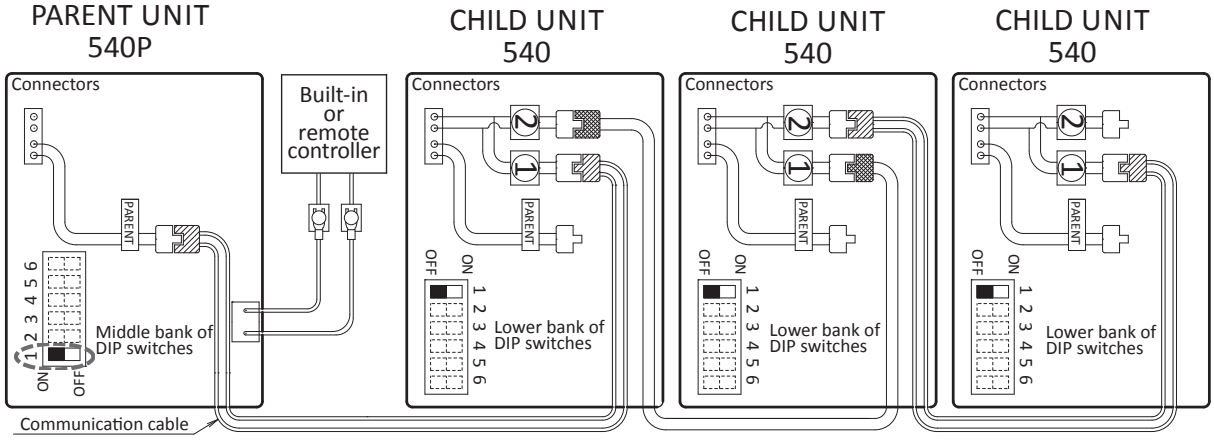
(A) 540P model computer board

WARNING

- **To change the DIP switch settings for the Easy-Link System, locate the MIDDLE bank of DIP switches at the upper left of the 540P computer board. (See diagrams below.)**
- **DO NOT adjust any other DIP switches .**
- **Turn off the power supply to the water heater before changing the DIP switch settings.**
- **Failure to observe this warning could result in carbon monoxide poisoning or death.**



(B) Basic diagram of connections between the Easy-Link System units



NOTICE

- The dark squares indicate the correct position of the DIP switch.
- Either a built-in controller or a remote controller is required for the Easy-Link System for ease of usage and maintenance.

APPLICATIONS

-Combination potable water heating and space heating-

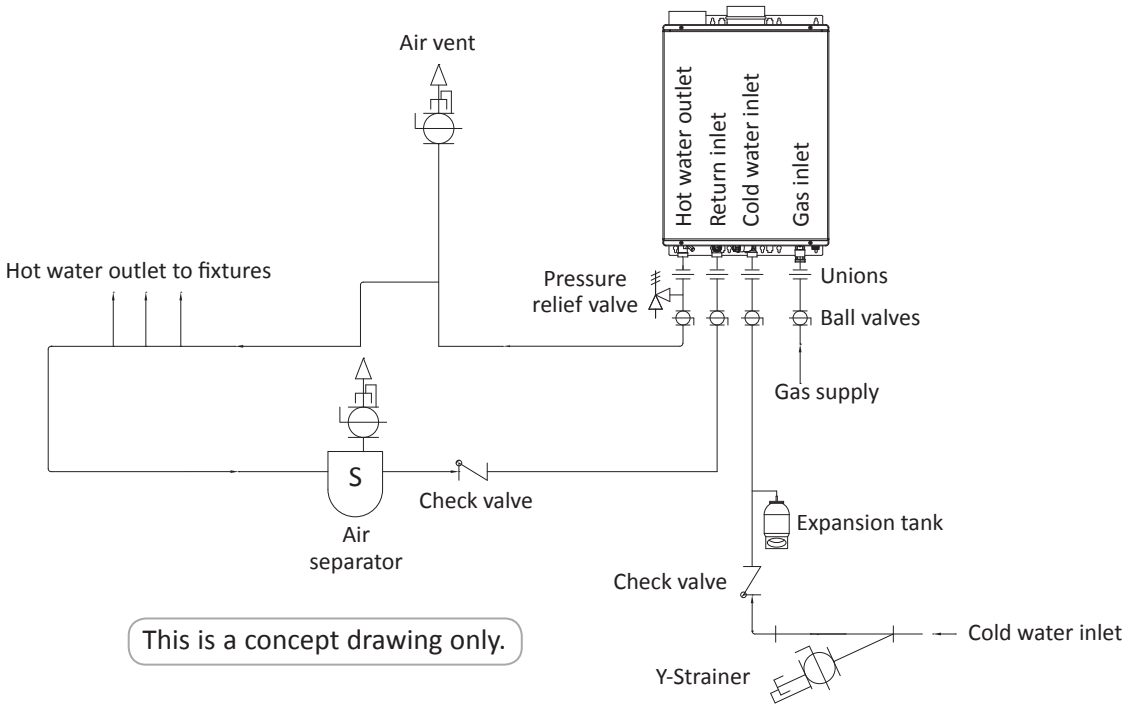
WARNING

- **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
- 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.
- Failure to observe these warnings could result in severe personal injury or death.

-Recirculation-

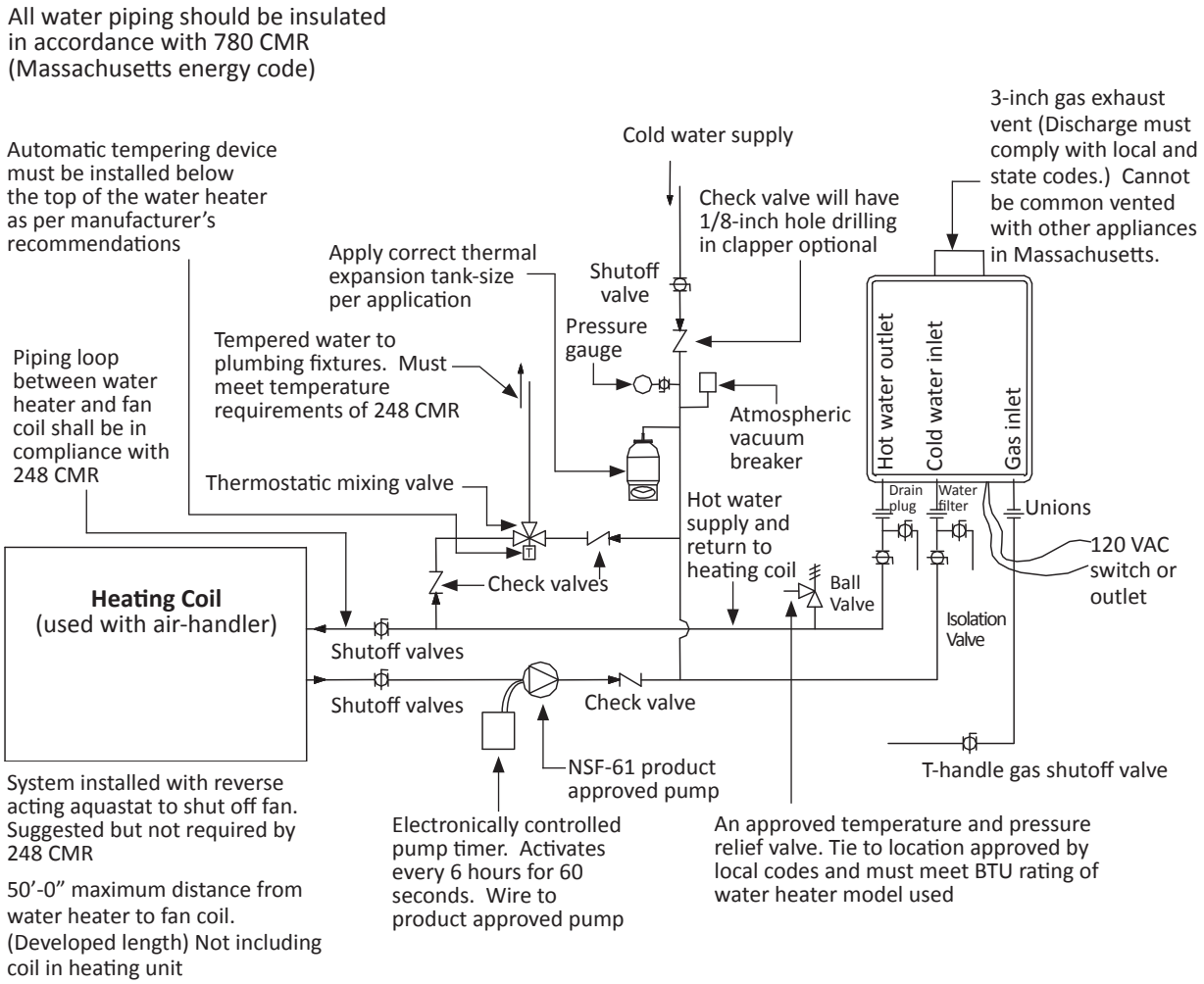
**The integrated recirculation pump is controlled by a programmed timer and ON/OFF temperatures are detected by thermistors in the water heater. Refer to pp. 52 to 57 to set the timer and ON/OFF temperatures.*

**Make sure flow rate of recirculation is not less than 2 GPM (7.5L/min) and no more than 4 GPM (15L/min) through the system. Refer to p. 58 for "Manual pump activation" and p. 60 for how to check the flow rate.*



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

Diagrammatic layout of radiant heating and domestic water heater.



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 current edition of the National Standard Code, ANSI Z21.10.3 • CSA 4.3.
- 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.
- The built-in pump may not provide sufficient flow for the heating coil. An additional field-supplied pump may be necessary.

INITIAL OPERATION

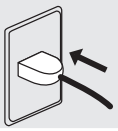
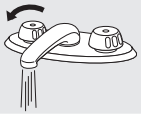
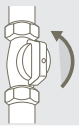
FOR YOUR SAFETY, READ BEFORE OPERATING

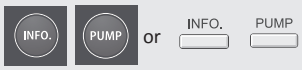
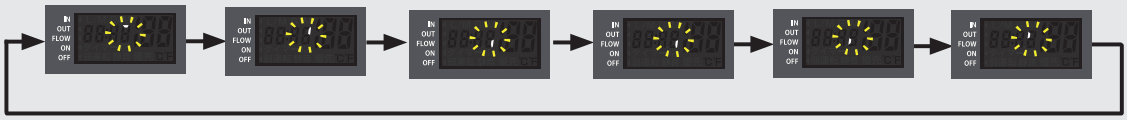
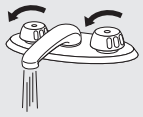
- **Check the GAS and WATER CONNECTIONS** for leaks before firing unit for the first time.
- Open the main gas supply valve to the unit using only your hand to avoid any spark. Never use tools. If the knob will not turn by hand, do not try to force it; call a qualified service technician. Forced repair 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 p. 31.
- 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.

	Initial Test Run	
1.	Turn on the 120 VAC, 60 Hz power supply to the water heater.	
2.	Open the valve on the inlet water and wait for all pipes to fill with water.	
3.	Clean filter of any debris. **Refer to p. 63 for instructions.**	
4.	Open a hot water tap to verify that water is flowing to that tap, then close the hot water tap.	
5.	Open the manual gas valve.	

	Initial Test Run	
	Start pump operation test by built-in controller or remote controller.	
	Press the ON/OFF button on the controller so the STAND BY LED turns off.	
6.	Press and hold "INFO." and "PUMP" simultaneously for at least three seconds, then the integrated pump starts operation for five minutes.	
	A segment of the zero is lighting as follows in clockwise order during pump operation test.	
		
7.	During the pump operation test, open and close a faucet in the loop several times to relieve air in the pipe. If air is stuck in the pump, it can cause pump failure or decreased water flow.	
8.	Check recirculation water flow. Refer to p. 60. Make sure the flow rate is approx. 2 to 3 GPM. If the flow rate is less than 2 GPM, there is a possibility that air is stuck in the pump. Open and close the faucet again to relieve air.	Water flow (EX.: 3.0 GPM)
9.	After finishing the pump operation test, complete the following procedures (Refer to pp. 51 to 55.): • OUTLET WATER TEMPERATURE SETTING • SETTING THE TIME • SETTING PUMP TIMERS • SELECTING A PUMP TIMER	
10.	Now you are ready to enjoy hours of endless hot water.	

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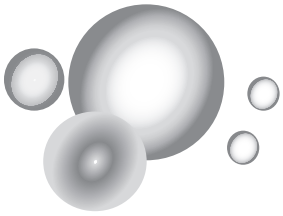


Owner's Guide

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.

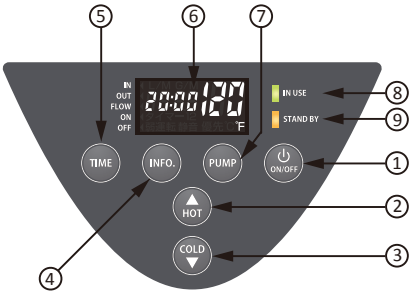
A pressure relief valve listed as complying with the standard for Relief Valve and Automatic Gas Shutoff Devices for Hot Water Supply System, ANSI Z21.22 • CSA 4.4, shall be installed at the time of installation of the water heater in the location specified by the manufacturer. Local codes shall govern 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

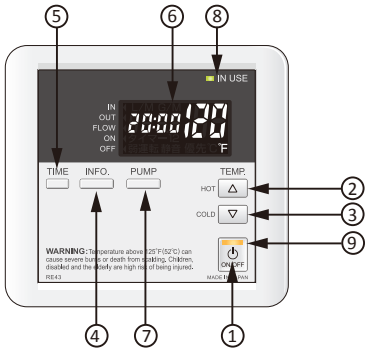
BUILT-IN CONTROLLER and REMOTE CONTROLLER

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

Built-in controller



Remote controller



No.	Description	Note	No.	Description	Note
1	"ON/OFF" Button	Press this button to start or stop operation.	5	"TIME" Button	Press this button to set the current time.
2	"HOT" Button	Press the "HOT" button or the "COLD" button to set the outlet water temperature, the current time, and PUMP TIMER.	6	LCD	The current time, set temperature, error code and other information are displayed.
3	"COLD" Button		7	"PUMP" Button	Press this button to set and control the pump operation.
4	"INFO." Button	Press the "INFO." button to display the inlet & outlet water temperature and water flow and set the outlet temperature, pump choosing, and unit conversion.	8	IN USE LED	The LED lights during combustion.
			9	STAND BY LED	The LED lights when power is on.

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.

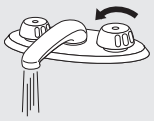
GENERAL

WARNING

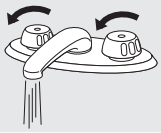
Temperatures above 125 °F (52 °C) can cause severe burns or death from scalding. Children, disabled and the elderly are at high risk of being injured.

°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.



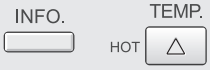
3. When finished, close the water fixtures.

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.)

OUTLET WATER TEMPERATURE SETTING

-Set temperature-

	Operation	Controllers	
		Built-in controller	Remote controller
1.	Turn on the 120 VAC power supply to the unit.		
2.	Press the **"ON/OFF"** button on the controller in order to turn the controller on.		
3.	When ON, the STAND BY LED is lit.		
4.	It shows the set temperature of output water 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 in 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 TABLE OF CONTROLLER

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

*Factory setting (Default): 120 °F (50 °C)

NOTICE

- The controllers have an energy saving mode. Five minutes after the water heater stops operating, the backlight of the controllers turns off.
- The backlight of the controllers will turn back on once the water heater begins firing again.

SETTING THE TIME

	Operation	Controllers	
		Built-in controller	Remote controller
1.	Turn on the 120 VAC power supply to the unit.		
2.	Press the **"TIME"** button on the controller in order to set the time. This operation is available regardless of ON/ OFF of the controller.		
	The time in the display will flash. The controllers can only have 24 hours indication of time.		
3.	Press the **"HOT"** button or **"COLD"** button to set the time. Press and hold the "HOT" or "COLD" button to adjust the time more quickly. **NOTICE**: The time is displayed in twenty-four hour clock time. For example, 11:00 is 11:00 a.m. and 23:00 is 11:00 p.m.		
4.	Press the **"TIME"** button on the controller in order to save and exit.		
	When the remote is on, the current time and set temperature are displayed. When the remote is off, the display turns off.	OR	

PUMP OPERATION TIMERS

The built-in controller and remote offer two timer settings for the pump operation: PUMP TIMER 1 and TIMER 2.
The pump will only operate during the times set for TIMER 1 and TIMER 2.
There are four options for pump timer operation.

1. Both PUMP TIMER 1 and PUMP TIMER 2 are activated.
2. Neither PUMP TIMER 1 nor PUMP TIMER 2 are activated.
   (The recirculation pump will never operate in this mode.)
3. Only PUMP TIMER 1 is activated.
4. Only PUMP TIMER 2 is activated.

NOTICE: Set the time for PUMP TIMER 1 and PUMP TIMER 2 before you select a pump timer option. Follow the steps in SETTING THE TIME, then complete the steps in Setting pump timers.

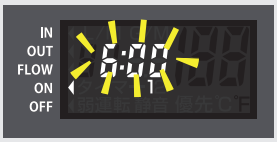
PUMP TIMERS 1 & 2 activated

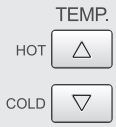
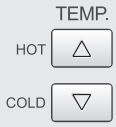
NO PUMP TIMER activated

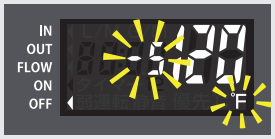
Only PUMP TIMER 1 activated

Only PUMP TIMER 2 activated

- Setting pump timers -

	Operation	Controllers	
		Built-in controller	Remote controller
1.	Turn on the 120 VAC power supply to the unit.		
2.	Press and hold the **"PUMP"** button on the controller for at least 3 seconds to enter the pump timer setting mode. This operation is available regardless of ON/OFF of the controller.		
	The ON time for PUMP TIMER 1 will flash, indicating that you can set the start time.		
3.	Press the **"HOT"** button or **"COLD"** button to select the time. Press and hold the "HOT" or "COLD" button to adjust the time more quickly. **NOTICE**: The time is displayed in twenty-four hour clock time. For example, 11:00 is 11:00 a.m. and 23:00 is 11:00 p.m.		
4.	Press the **"PUMP"** button when the desired time flashes on the display.		
	The OFF time for PUMP TIMER 1 will flash, indicating that you can set the end time.		
5.	Press the **"HOT"** button or **"COLD"** button to select the time. Press and hold the "HOT" or "COLD" button to adjust the time more quickly. **NOTICE**: The time is displayed in twenty-four hour clock time. For example, 11:00 is 11:00 a.m. and 23:00 is 11:00 p.m.		
6.	Press the **"PUMP"** button when the desired time flashes on the display.		
	The ON time for PUMP TIMER 2 will flash, indicating that you can set the start time.		

<table>
<tr><th></th><th>Operation</th><th colspan="2">Controllers</th></tr>
<tr><th></th><th></th><th>Built-in controller</th><th>Remote controller</th></tr>
<tr><td>7.</td><td>Press the "HOT" button or "COLD" button to select the time. Press and hold the "HOT" or "COLD" button to adjust the time more quickly.
NOTICE: The time is displayed in twenty-four hour clock time. For example, 11:00 is 11:00 a.m. and 23:00 is 11:00 p.m.</td><td>
</td><td> 
</td></tr>
<tr><td rowspan="2">8.</td><td>Press the "PUMP" button when the desired time flashes on the display.</td><td>
</td><td>
</td></tr>
<tr><td>The OFF time for PUMP TIMER 2 will flash, indicating that you can set the end time.</td><td colspan="2">
</td></tr>
<tr><td>9.</td><td>Press the "HOT" button or "COLD" button to select the time. Press and hold the "HOT" or "COLD" button to adjust the time more quickly.
NOTICE: The time is displayed in twenty-four hour clock time. For example, 11:00 is 11:00 a.m. and 23:00 is 11:00 p.m.</td><td>
</td><td>
</td></tr>
<tr><td>10.</td><td>Press the "PUMP" button when the desired time flashes on the display.</td><td>
</td><td>
</td></tr>
<tr><td rowspan="3">11.</td><td>The following steps will set the temperature drop that must occur before the recirculation pump will activate.</td><td colspan="2">
</td></tr>
<tr><td colspan="3"><table>
<tr><td rowspan="2">Temperature drop below set temp. at which pump turns on</td><td>°F</td><td>-10</td><td>-15</td><td>-20*</td><td>-25</td><td>-30</td><td>-35</td><td>-40</td></tr>
<tr><td>°C</td><td>-6</td><td>-8</td><td>-11</td><td>-14</td><td>-17</td><td>-19</td><td>-22</td></tr>
</table>
*The value has been preset at the factory. (Default)</td></tr>
<tr><td>Press the "HOT" button or the "COLD" button to select the temperature at which the pump will activate.</td><td>
</td><td> 
</td></tr>
<tr><td>12.</td><td>Press the "PUMP" button on the controller to save your settings.</td><td>
</td><td>
</td></tr>
</table>

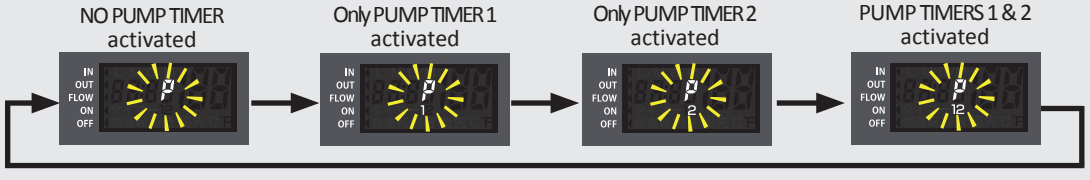
	Operation	Controllers	
		Built-in controller	Remote controller
13.	The following steps will set the **temperature drop** that must occur before the recirculation pump will turn off.		

Temperature drop below set temp. at which pump turns off	°F	-5*	-10	-15	-20	-25	-30	-35
	°C	-3	-6	-8	-11	-14	-17	-19

*Preset at the factory. (Default)

	Press the **"HOT"** button or the **"COLD"** button to select the temperature at which the pump will turn off.		
14.	Press the **"PUMP"** button on the controller to save your settings.		
	When the controller is on, the current time and set temperture in the display turns on. When the controller is off, the display turns off.	OR	

- Selecting a pump timer-

	Operation	Controllers	
		Built-in controller	Remote controller
1.	Press the **"PUMP"** button on the controller to set the mode. (The options are shown in step 3.) This operation is available regardless of the ON/OFF status of the controller.		
2.	The current status of the **PUMP TIMER** will flash for 10 seconds. During this time, you can change the mode. Otherwise, the mode will remain unchanged.		
3.	Press the **"PUMP"** button on the controller in order to change the option. The order of the option is as follows.		
			
4.	Press the **"INFO"** button on the controller in order to save your setting.		

-Display example-

The display on the controller indicates which PUMP TIMER is set by displaying a number below the time: 1, 2, or 12. (12 indicates PUMP TIMER 1 and PUMP TIMER 2.)

The arrow to the right of ON or OFF indicates the current status of the PUMP TIMER(s). If the current time falls within the time range set for a PUMP TIMER, the arrow will point toward ON. (The timer is ON.)

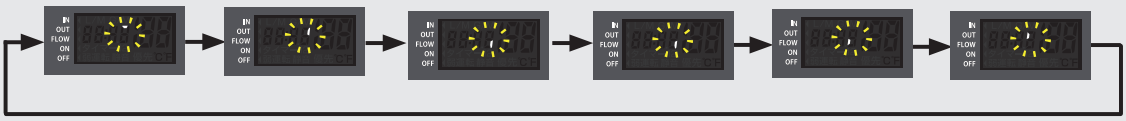
If the current time falls outside the time range set for a PUMP TIMER, the arrow will point toward OFF. (The timer is OFF.)

See below for examples of each scenario. In each scenario below, PUMP TIMER 1 is set to activate at 6:00 AM (6:00) and deactivate at 9:00 AM (9:00). PUMP TIMER 2 is set to activate at 6:00 PM (18:00) and deactivate at 9:00 PM (21:00).

	Examples	Controllers	
		Built-in controller	Remote controller
1.	The display shows that PUMP TIMER 1 is in operation. The current time falls within the time range that is set for for PUMP TIMER 1. Current time: 8:00 AM (8:00) Set temperature of output water: 120 °F PUMP TIMER 1: SET PUMP TIMER 2: OFF		
2.	The display shows that PUMP TIMER 1 is NOT in operation. The current time falls outside the time range that is set for for PUMP TIMER 1. Current time: 10:00 AM (10:00) Set temperature of output water: 120 °F PUMP TIMER 1: SET PUMP TIMER 2: OFF		
3.	The display shows that PUMP TIMER 2 is in operation. The current time falls within the time range that is set for for PUMP TIMER 2. Current time: 8:00 PM (20:00) Set temperature of output water: 120 °F PUMP TIMER 1: OFF PUMP TIMER 2: SET		
4.	The display shows that PUMP TIMER 2 is NOT in operation. The current time falls outside the time range that is set for for PUMP TIMER 2. Current time: 10:00 PM (22:00) Set temperature of output water: 120 °F PUMP TIMER 1: OFF PUMP TIMER 2: SET		
5.	The display shows that PUMP TIMER 1 and PUMP TIMER 2 are set, and one of them is in operation. In this example, PUMP TIMER 1 is running because it is set to activate between 6:00 AM and 9:00 AM. (See above.)Current time: 7:00 AM (7:00) Set temperature of output water: 120 °F PUMP TIMER 1: SET PUMP TIMER 2: SET		
6.	The display shows that PUMP TIMER 1 and PUMP TIMER 2 are set, and none of them is in operation. The current time falls outside the time ranges that are set for for PUMP TIMER 1 and PUMP TIMER 2. Current time: 10:00 AM (10:00) Set temperature of output water: 120 °F PUMP TIMER 1: SET PUMP TIMER 2: SET		

-Pump operation test-

The following procedure will operate the pump. This is useful to verify that the pump is operating properly and to check the water flow rate.

	Operation	Controllers	
		Built-in controller	Remote controller
1.	Press the ON/OFF button on the controller so the STAND BY LED turns off.		
2.	Press and hold "INFO." and "PUMP" simultaneously for at least 3 seconds, then the integrated pump starts operation for 5 minutes.		
3.	A segment of the zero (on the right) is lit as follows in clockwise order during forced pump operation. 		
4.	The pump will stop operation automatically after five minutes. OR Press the "ON/OFF" button to stop pump operation test.		

-Manual pump operation-

This operation runs the pump and fire the water heater each time the “PUMP” button is pushed to minimize energy consumption. The pump runs until water temperature at the thermistor inside the water heater reaches 102 °F (38.9 °C) or the water temperature at the thermistor rises 10 °F (5.6 °C) above the initial temperature of the water. The pump runs for five minutes at the longest. No. 5 DIP switch of the lower bank needs to be changed to "ON" position in the operation.

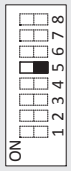
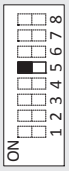
Note: The pump timer is not available when the No. 5 DIP swtch of the lower bank is set to "ON".

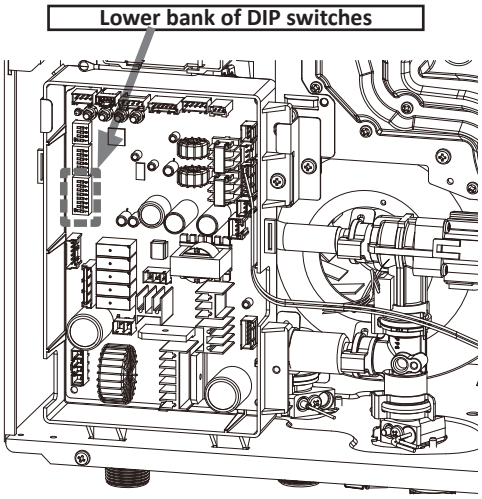
	Operation	Controllers	
		Built-in controller	Remote controller
1.	Press the "PUMP" button to start pump operation and fire the water heater.		
2.	"P" and the set temperature are indicated (on the right) during Manual pump operation.		
3.	The pump will stop automatically in five minutes and the current set temperature and time will be displayed on the screen.		

WARNING

- **For manual pump operation, adjust only the No. 5 DIP switch in the LOWER bank of DIP switches. (See 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.**

Set DIP switch shown in the table below.

Manual pump operation		
Lower bank of DIP switches	 No. 5 : OFF **DEFAULT**	 No. 5 : ON



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:

	Operation	Controllers	
		Built-in controller	Remote controller
1.	Press the **"INFO"** button on the controller to enter the information mode.		
2.	Press the **"INFO"** button to display the inlet water temperature.	Inlet water temperature (EX.: 60 °F)	
3.	Press the **"INFO"** button again to display the outlet water temperature.	Outlet water temperature (EX.: 120 °F)	
4.	Press the **"INFO"** button again to display the water flow.	Water flow (EX.: 3.5 GPM)	
5.	Press the **"INFO"** button to exit the 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	
		Built-in controller	Remote controller
1.	Press the **"ON/OFF"** button on the controller in order to turn the controller on.		
2.	When ON, the STAND BY LED is lit.		
3.	The current set temperature and time will be displayed on the screen.	(EX.: 120 °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.: 50 °C)	

NOTICE When installed on an indoor heater, the 100276687 (TM-RE43) has priority for set temperature over the built-in controller.

SETTING THE TEMPERATURE ON THE PCB (WITHOUT BUILT-IN CONTROLLER or REMOTE CONTROLLER)

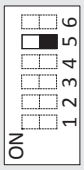
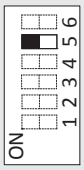
WARNING

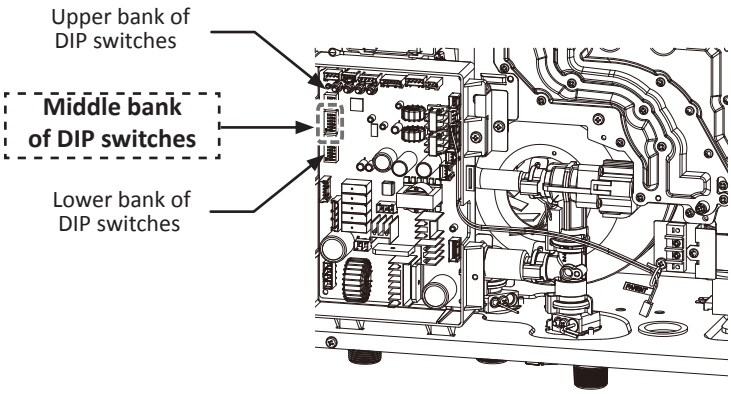
- **To set the temperature, adjust only the No. 5 DIP switch in the MIDDLE bank of DIP switches. (See below.) DO NOT adjust the other DIP switches.**
- **Turn off the power supply to the water heater before changing the DIP switch settings.**
- **Failure to observe these warnings could lead to carbon monoxide poisoning, severe personal injury, or death.**

There are two preset temperatures (120°F (50°C) and 140°F (60°C)) that you can select when the temperature controller is inoperable. To do so, adjust the appropriate DIP switch as shown in the table below. When the remote controller is in normal operation, the set temperature of the remote 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).

Middle bank of DIP switches

120 °F (50 °C) DEFAULT	140 °F (60 °C)
	
No.5 : OFF	No.5 : ON



NOTE: Only change the switches with dark squares. The dark squares indicate the correct DIP switch positions.

FLOW

- The flow rate through the water heater is limited to a maximum of 10.0 GPM (38 L/min) for the 540P model.
- The temperature setting, along with the supply temperature of the water will determine the flow rate output of the unit.
- Please refer to the temperature vs. gallons per minute chart on p. 76 to determine the likely flow rates based on your local ground water temperature and your desired outlet water temperature.
- Refer to the table below 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

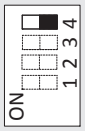
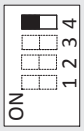
WARNING

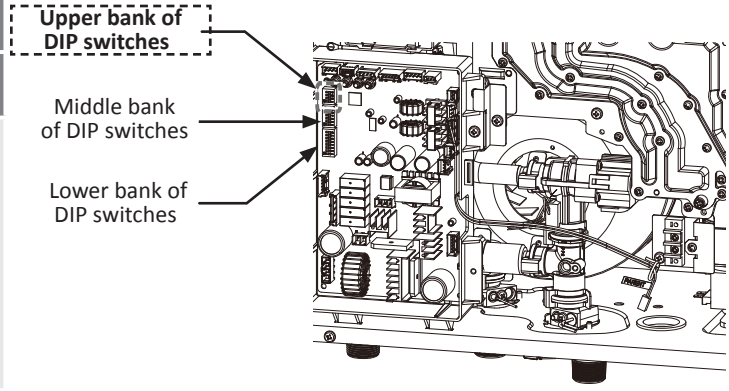
- **To set pump operation for freeze protection, adjust only the No. 4 DIP switch in the UPPER bank of DIP switches. (See below.) DO NOT adjust the other DIP switches.**
- **Turn off the power supply to the water heater before changing the DIP switch settings.**
- **Failure to observe these warnings could lead to carbon monoxide poisoning, severe personal injury, or death.**

- There are two systems for freeze protection in the water heater-**heating block system** and **recirculation system** with the integrated pump.
- This water heater comes equipped with heating blocks to protect the unit against damages 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.
- This water heater can recirculate the water in the pipes installed in the recirculation system with the integrated pump to prevent freezing. When the integrated thermistors detect water temperature below 50 °F (10 °C), the pump will activate and recirculate the water in the recirculation line.*
- 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. 63.
  2. Disconnect power to your heater.

  This will keep your unit from freezing and being damaged.

*Recirculation system for freeze protection is only activated when the built-in/remote controller is off. When the integrated thermistors detect the water temperature above 52 °F (11 °C) over five minitues, the operation is deactivated. If you want to stop the recirculation system for freeze protection, change the DIP switch setting below.

Pump operation for freeze protection	
Active	Inactive
	
No.4 : OFF	**No.4 : ON DEFAULT**



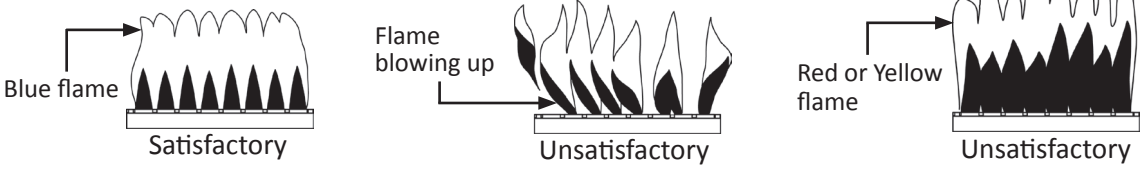
NOTICE Only pipes within the water heater are protected by the freeze protection system. Any water pipes (hot or cold) located outside the unit will not be protected. Properly protect and insulate these pipes from freezing.

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 this page.)
- 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 of burner flames (see below) through the burner window in the burner assembly located at the middle of the water heater.



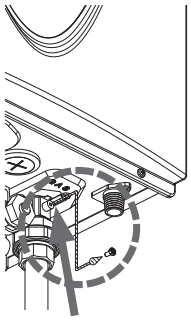
The manufacturer recommends having the unit checked once a year or as necessary by a licensed technician. If repairs are needed, any repairs should be done by a licensed technician.

-Measuring inlet gas pressure-

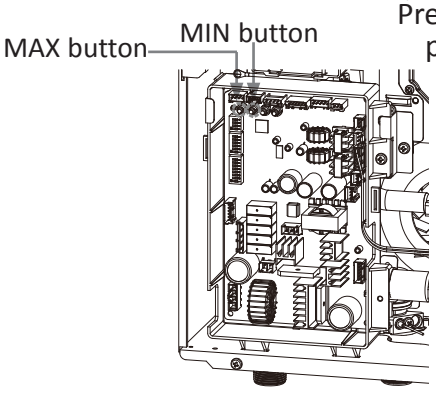
WARNING

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**.



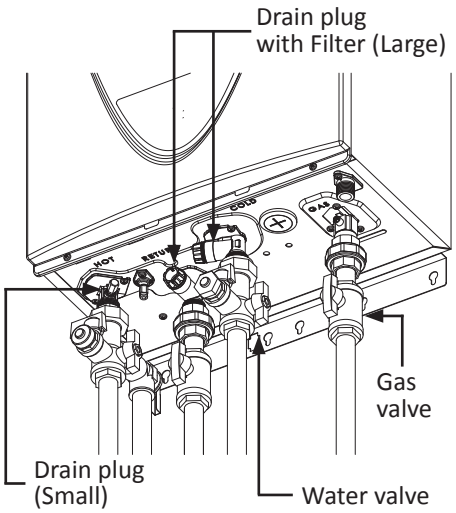
1. Shut off the manual gas valve on the gas supply line.
2. Remove the screw from the pressure port which is located on the gas inlet of the water heater shown in the diagram on the right.
3. Connect the manometer to the pressure port and zero the manometer.
4. Re-open the manual gas valve. Verify that 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 diagrams 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. 31.
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. (NOTICE: In Canada, the pressure drops cannot exceed those specified in CSA B149.1.)
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 diagram.) Take a supply gas pressure reading and verify that it is within the specified inlet gas pressure range.

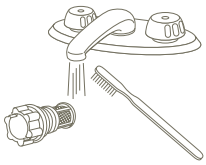


540P Computer board

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.
   - If the heater is part of an Easy-Link or Multi-Unit System, close the inlet and outlet water valves to isolate the heater. Then proceed to step 6.
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.

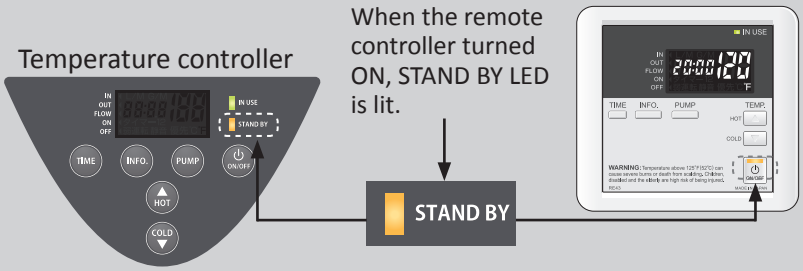
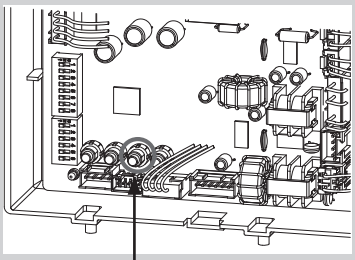




TROUBLESHOOTING

GENERAL

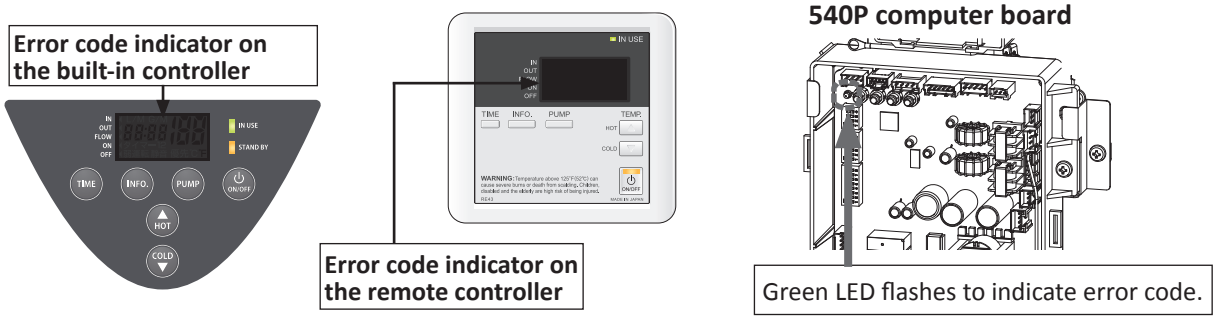
	PROBLEM	SOLUTIONS
TEMPERATURE and AMOUNT OF HOT WATER	It takes a long time to get hot water at the fixtures.	• Check to see if a recirculation timer is active. If not, it will take time for the hot water to get from the heater to the fixture. • Check the recirculation pump for proper flow. • The inlet filters on the return and inlet connections may need to be cleaned.
	The water is not hot enough.	• Compare the flow and temperature. See the charts on p. 76. • Check cross plumbing between cold water lines and hot water lines. • Is the gas supply valve open fully? (p. 44) • Is the gas line sized properly? (p. 31) • Is the gas supply pressure sufficient? (pp. 31 and 62) • Is the set temperature set too low? (pp. 51 and 60)
	The water is too hot.	• Is the set temperature set too high? (pp. 51 and 60)
	The hot water is not available when a fixture is opened.	• Make sure the unit has 120 VAC, 60 Hz power supply. • If you are using the remote controller and/or temperature controller, is the power button turned on? • Is the gas supply valve open fully? (p. 44) • Is the water supply valve open fully? (p. 44) • Is the filter on the cold water inlet and return connection clean? (p. 63) • Is the hot water fixture sufficiently open to draw at least 0.5 GPM (1.9 L/min) through the water heater? (p. 50) • Is the unit frozen? (p. 61) • Is there enough gas in the tank / cylinder? (For Propane model)
	The hot water turns cold and stays cold.	• Is the flow rate enough to keep the water heater running? (p. 50) • If there is a recirculation system installed, does the recirculation line have enough check valves? (p. 33) • Is the gas supply valve open fully? (p. 44) • Is the filter on the cold water inlet and return connection clean? (p. 63) • Are the fixtures clean of debris and obstructions? • Check if the flow rate is too low. (p. 50)
	Fluctuation in hot water temperature.	• Is the filter on the cold water inlet and return connection clean? (p. 63) • Is the gas line sized properly? (p. 31) • Is the supply gas pressure sufficient? (pp. 31 and 62) • Check for cross connection between cold water lines and hot water lines.

	PROBLEM	SOLUTIONS
WATER HEATER	Unit does not ignite when water goes through the unit.	• Is the flow rate over 0.5 GPM (1.9 L/min)? (p. 50) • Is the filter on cold water inlet and return connection clean? (p. 63) • Check for reverse connection and cross connection. • If you use the remote controller and/or built-in controller, is the power button turned on? • Check if the inlet temperature is too high.
	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 (USA) 1-888-479-8324 (Canada)
BUILT-IN CONTROLLER AND REMOTE CONTROLLER	Controller does not display anything when the power button is turned on.	• Make sure the unit is supplied with power. • Make sure the connection to the unit is correct. (pp. 38 and 39) NOTICE: When the unit has not operated for five minutes or more, the display of the controllers turns off to conserve energy.  Although the controller of the parent unit will display the set temperature at the Easy-Link System, the controller of the child unit will not display the set temperature.
	An ERROR code is displayed.	• Please see pp. 68 and 69.
EASY-LINK SYSTEM	How are the unit numbers assigned?	• For an Easy-Link System, the Parent unit is always labeled #1 and all other subsequent Child units are numbered randomly. • To check which numbers are assigned to which Child units, push the button on the computer board of any Child unit as shown below. The unit number will be displayed on the built-in controller of the Child unit and/or the remote controller of the Child unit, if installed. (Refer to pp. 40 and 41.) Child units : 540 models 

ERROR CODES

-General-

- The units have self-diagnostic functions for safety and convenience when troubleshooting.
- If there is a problem with the installation or the unit, the error code will be displayed on the built-in controller or remote controller.
- Consult the table on the following pages for the description of each error code.



-Single unit Installations-

<u>Example</u>: If your unit has the "321" error code (which signifies an inlet thermistor failure)

- **Indicator on the built-in controller and/or remote controller:** "321" will be displayed on the screen in its entirety.

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	on on off off on on off off on on off

Error Indication

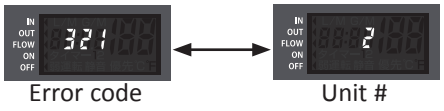
Error Code on the temperature controller	Green LED	
	The number of flashes	Flash pattern
031 701 711	One	on off on off
311 321 331 341 351 391 441	Two	
111 121	Three	
611 631 651 661	Four	
101 941 991	Five	
510 551 721	Six	0.5 sec. on, 0.5 sec. off / 3 sec. off

-How error codes display in an Easy-Link System-

Error codes will be displayed differently with units installed in an Easy-Link System. It will show both the error code and which unit has the error code. Below is an example of how the error code of "321" is displayed in an Easy-Link System.

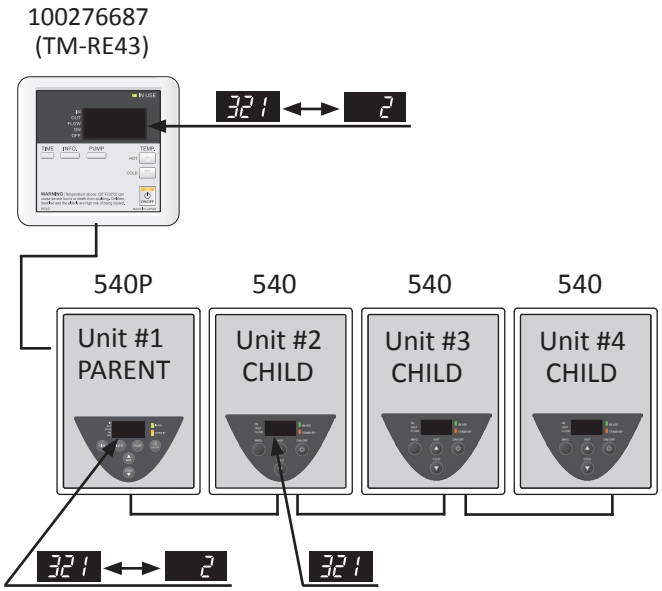
Example: Unit #2 with a "321" error code (inlet thermistor failure)

- **Indicator on the built-in controller and/or remote controller of Parent unit*:** "321" and "2" will alternately flash on the display.



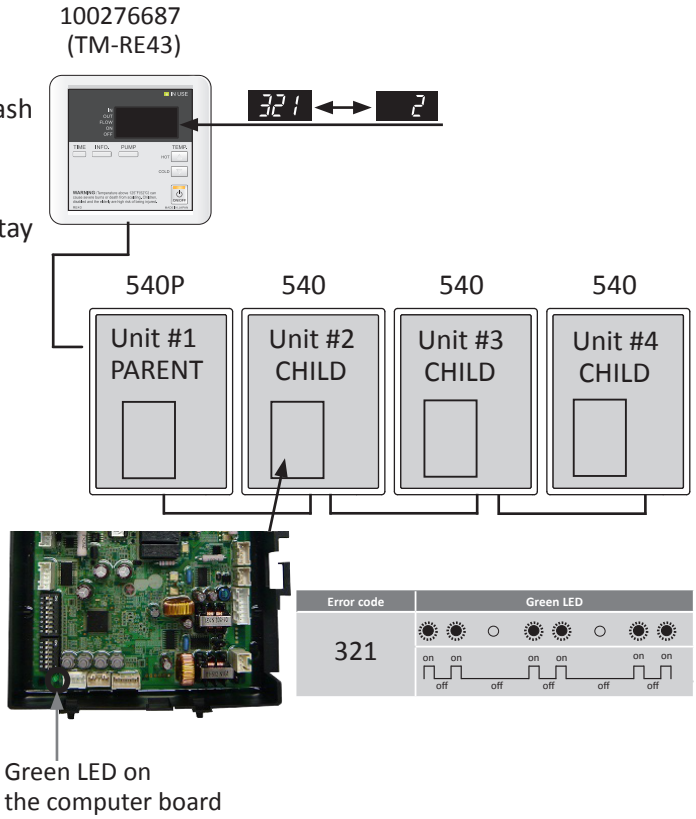
Indoor model installation

- **Unit #2:** "321" will flash on the display. The green LED on the computer board will be flashing twice, just like in the single unit example.
- **Unit #3 and #4:** These units will not display anything, as the error code does not pertain to them.



Outdoor model installation

- **Unit #2:** The green LED on the computer board will flash twice, just like in the single unit example.
- **Unit #3 and #4:** The green LED on the computer board will stay off.



*If the 540P Indoor model is the PARENT unit and the remote controller is connected to the unit, the remote controller has priority over the built-in controller.

-Fault analysis-

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**.

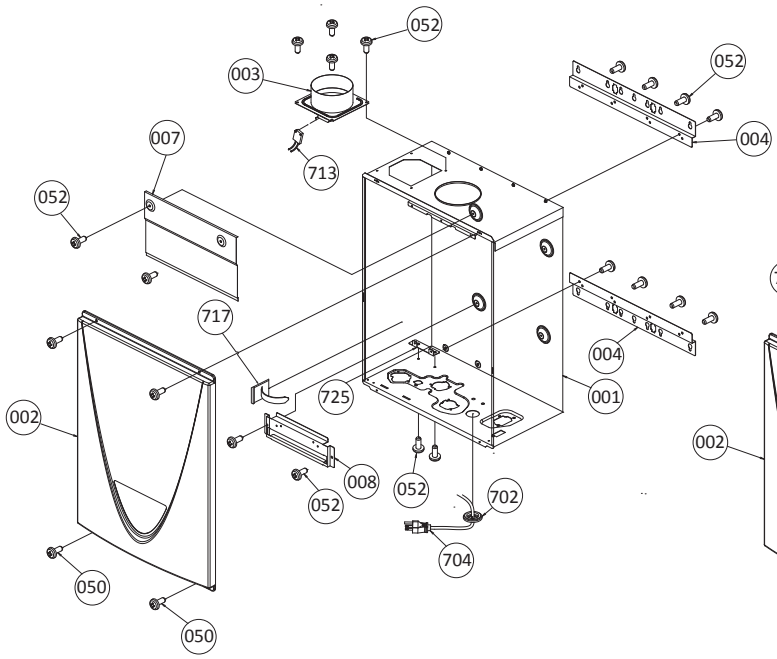
Remote	Green LED	Malfunction description	Diagnosis
031	One Time	Incorrect DIP switch setting	• Check the DIP switch settings on the PCB (Part #701).
101	Five Times	Warning for the "991" error code	• Check the gas type of the water heater. • Check if there is any blockage in the intake air and/or exhaust. • 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. • 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.
111	Three Times	Ignition failure	• Check if the Hi-limit switch (Part #412) is properly functioning. • Check for connection/breakage of wires (Part #413, 708, 709, 711), 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 water heater goes into combustion. • Check if there is leaking from heat exchanger (Part #401).
121	Three Times	Loss of flame	• Check if the Hi-limit switch (Part #412) is functioning properly. • Check for connection/breakage of wires (Part #413, 708, 709, 711), 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).
311	Two Times	Heat exchanger thermistor failure	• Check for connection/breakage of wires and/or debris on thermistor (Part #407, 408, 411, 715, 718, 731).
321	Two Times	Inlet thermistor failure	
331	Two Times	Outlet thermistor failure	
341	Two Times	Exhaust thermistor failure (Indoor model only)	
351	Two Times	Return Thermistor Failure	
391	Two Times	Air-fuel ratio rod failure	• Check for connection/breakage of wires (Part #709) and/or soot on the AFR rod (Part #108).
441	Two Times	Flow sensor failure	• Check for connection/breakage of wires and/or debris on the flow sensor impeller (Part #402).
510	Six Times	Abnormal main gas solenoid valve	• Check for connection/breakage of wires (Part #708) and/or burn marks on the computer board (Part #701).
551	Six Times	Abnormal gas solenoid valve	• Check for connection/breakage of wires (Part #708) and/or burn marks on the computer board (Part #701).

Remote	Green LED	Malfunction description	Diagnosis
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).
631	Four Times	Pump fault	• Check for connection/breakage of wires in the pump(Part #726). • Check if the water in the pump has frozen (Part #726).
651	Four Times	Flow adjustment valve fault (Easy-Link System only)	• Inspect the flow adjustment valve (Part #402), for connection/ breakage of wires, locked motor drive due to scale buildup, and/ or water leakage.
661	Four Times	Bypass valve fault	• Inspect the bypass valve (Part #403), for connection/breakage of wires, locked motor drive due to scale buildup, and/or water leakage.
701	One Time	Computer board fault	• Check for connection/breakage of wires (Part #714).
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 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 water heater and built-in controller (Indoor model only)	• Inspect the connections between the water heater and built-in controller. • Check the power supply of the water heater.
761	N/A	Miscommunication in Easy-Link System	• Check if the connections between the parent unit and the child units are correct. Refer to pp. 40 and 41.
941	Five Times	Abnormal exhaust temperature (Indoor model only)	• Check if the inlet and return water temperature is higher than 140°F (60°C) in the recirculation system.
991	Five Times	Imperfect combustion	• Check the gas type of the water heater. • Inspect the environment around the water heater. Determine how long the unit has been installed. • 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.

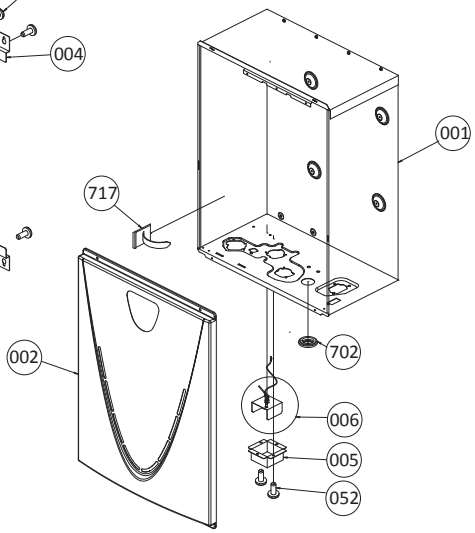
COMPONENTS DIAGRAM

Case assembly

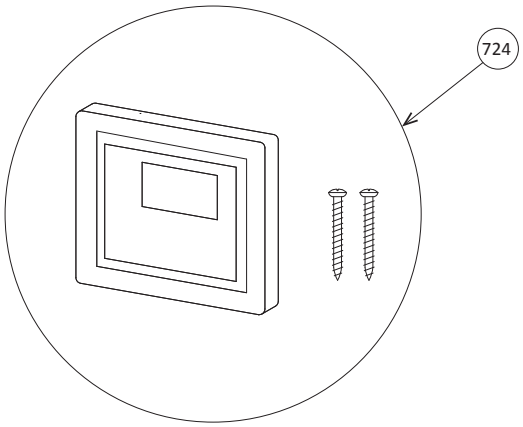
Indoor model



Outdoor model

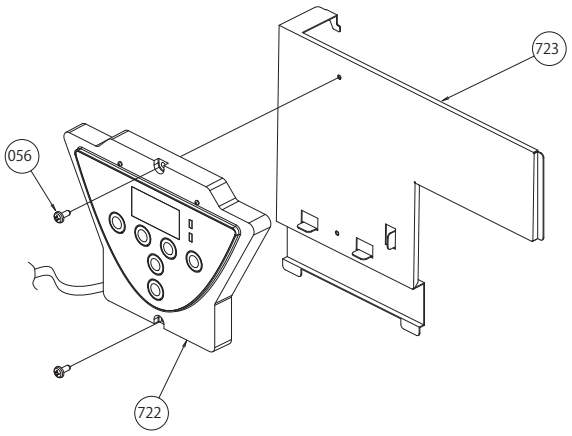


Temperature remote controller

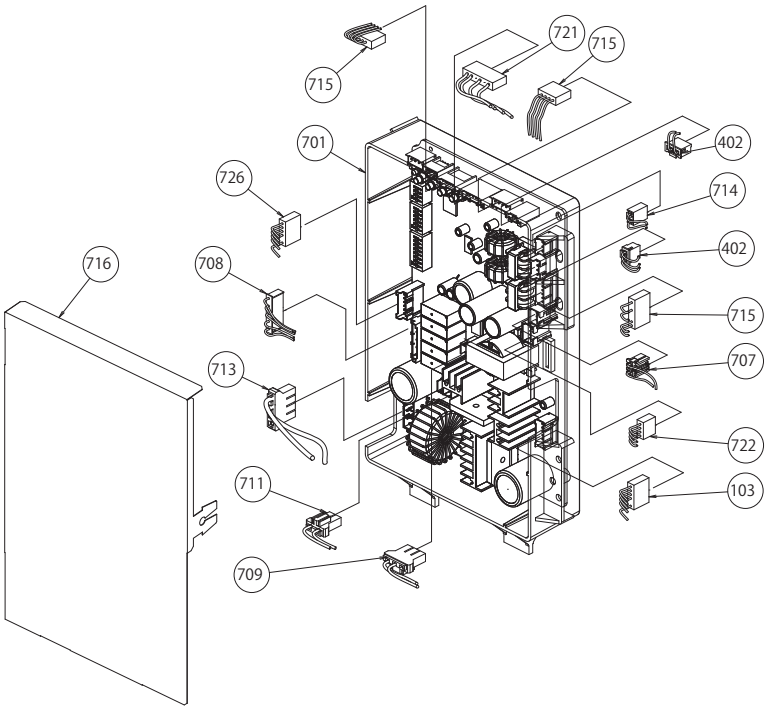


Built-in controller

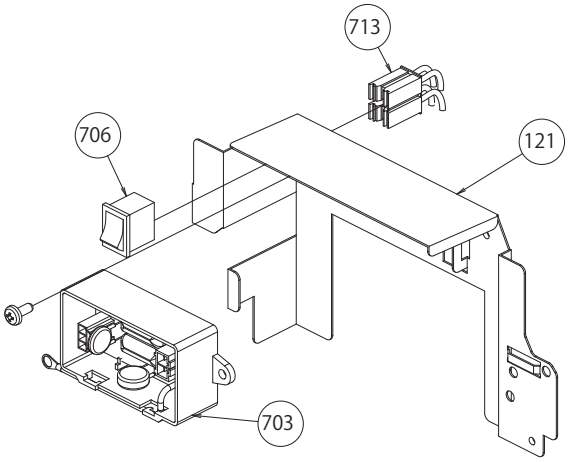
Indoor model



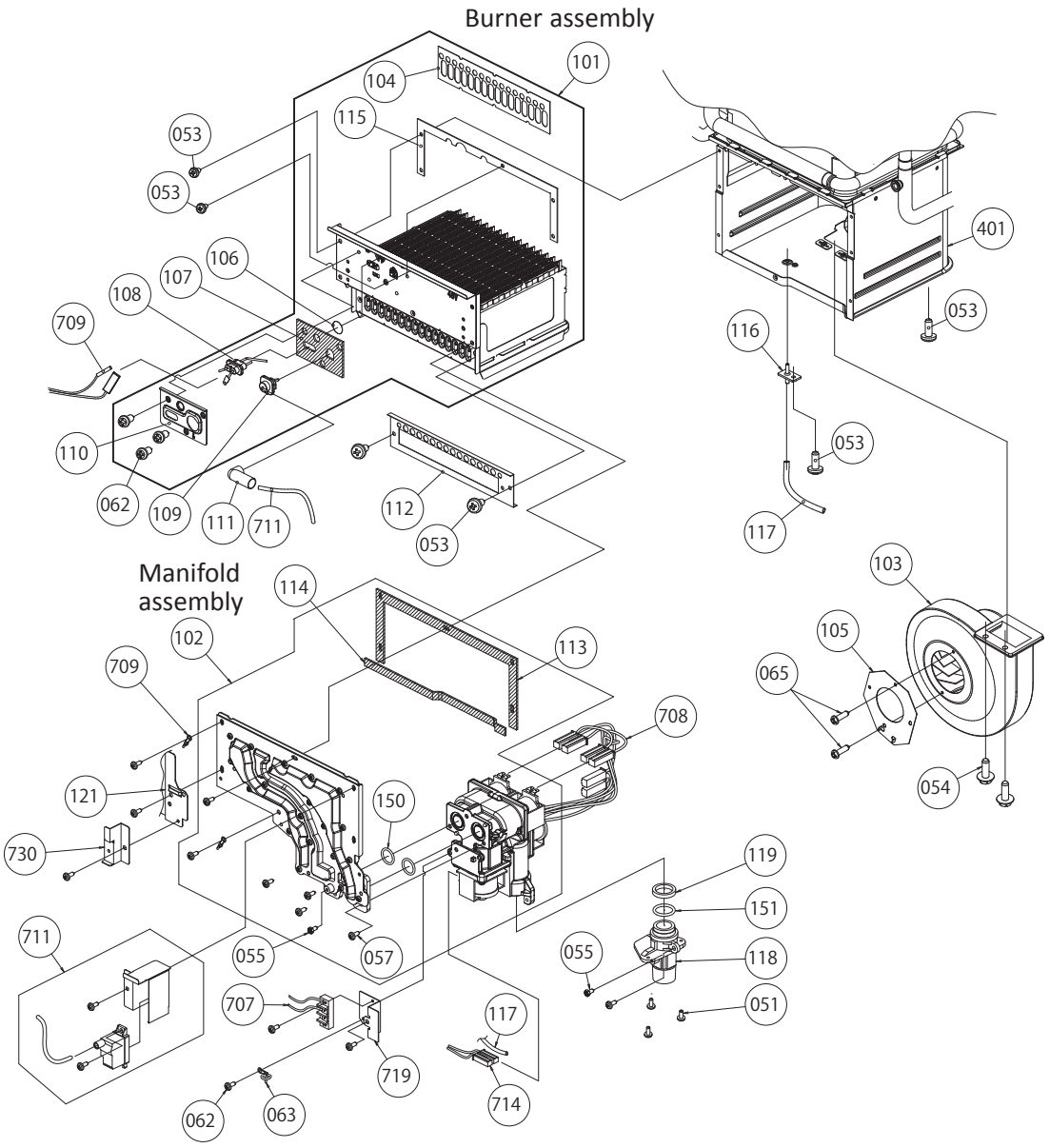
Computer board assembly



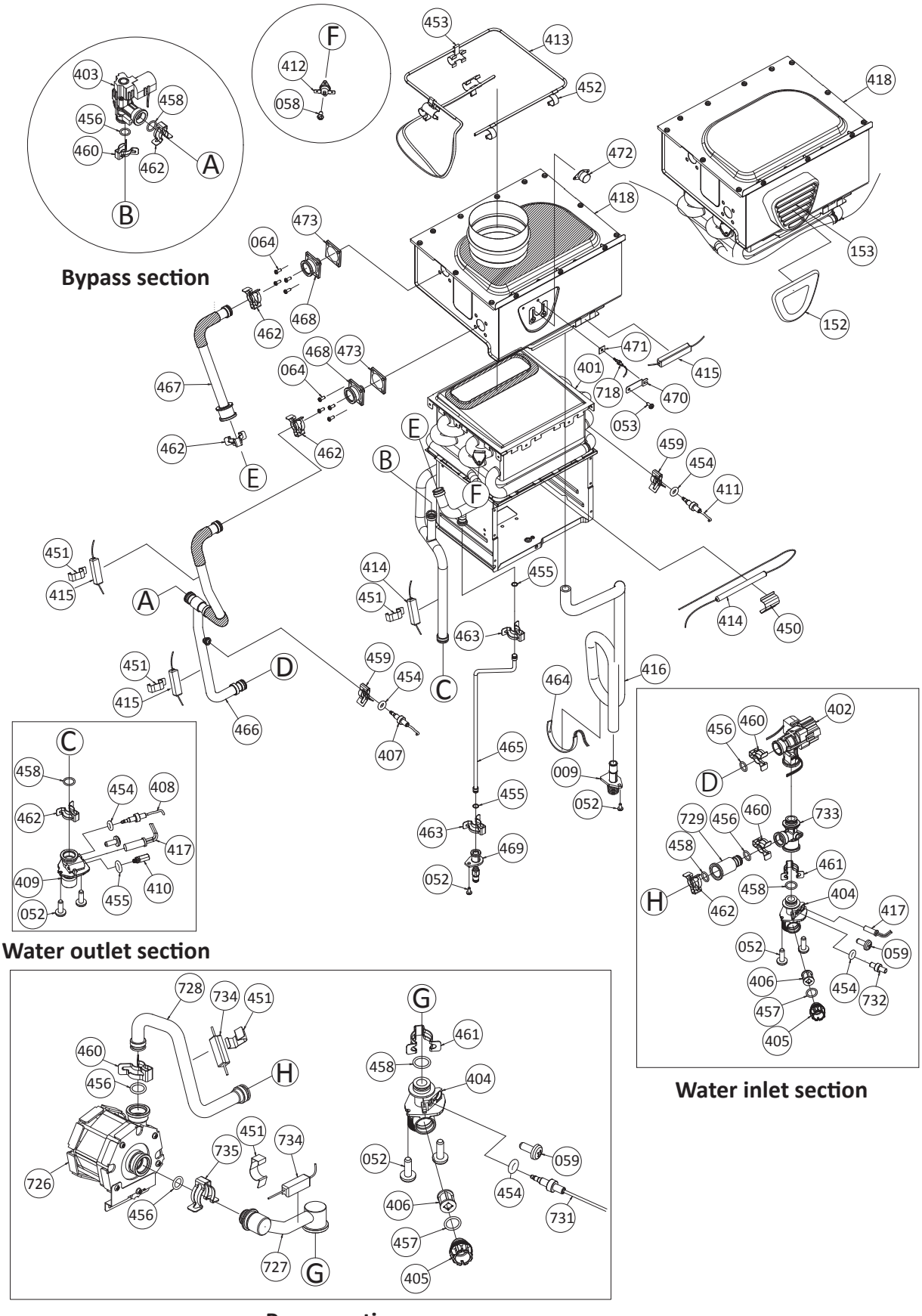
Surge box assembly



Burner assembly



Water way assembly



PARTS LIST

Item #	Description	Part #	
		540P	(AT-H3P)
001	Case assembly for Indoor model	N/A	EK617
	for Outdoor model	N/A	EK635
002	Front cover for 540P Indoor	100074665	EK158
	for 540P Outdoor	100074666	EK174
003	Intake air port assembly	100074667	EK170
004	Bracket	N/A	EK162
005	Junction box	100074668	EK190
006	Power supply cord assembly	100276679	EK637
007	Back guard panel	N/A	EK161
008	Chamber fixing plate	N/A	EK160
009	Condensate drain port	100074203	EKH23
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	Tap tight screw M4x12	100076269	EKK37
061	Plus bind Screw M3x6 FEZN	N/A	EK191
062	Pan screw M4x8 MFZN	100074526	EW00D
063	Wire clamp 60	100074233	EM167
064	Screw M4x10	N/A	EK230
065	Screw M3x6 SUS3 Binding head	100074514	EW00B
101	Burner assembly	100074670	EK192
102	Manifold with gas valve assembly LP	100074671	EK181
	Manifold with gas valve assembly NA	100074672	EK182
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	100074466	EM381
106	Burner window	100074218	EKK2V
107	Rod holder gasket	100074219	EKK2W
108	Flame rod	100074673	EK193
109	Igniter rod	100074222	EKK0F
110	Rod holder	100074221	EKK32
111	Rod cap	100074223	EKN61
112	Burner damper LP	100074674	EK183
	Burner damper NA	100074675	EK169
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	100074616	EK117
119	Gas inlet ring	100074526	EX00D
121	Surge box plate	N/A	EK618
150	O-ring P18 NBR (Black)	100074533	EZP18
151	O-ring P20 NBR (Black)	100074242	EK042
152	Silicon ring for Outdoor model	100074678	EK157
153	Exhaust port for Outdoor model	100074679	EK177

Item #	Description	Part #	
		540P	(AT-H3P)
401	Primary heat exchanger assembly for 540P model	100276637	EK621
402	Flow adjustment valve / Flow sensor	100074624	EK129
403	Bypass valve	100074625	EKD58
404	Water inlet	100074377	EKK1U
405	Inlet drain plug	100074381	EKK2B
406	Inlet water filter	100074382	EKK2C
407	Inlet thermistor	100276682	EK641
408	Outlet thermistor	100074374	EKK1A
409	Water outlet	100074681	EK208
410	Outlet drain plug	100074383	EKK2E
411	Heat exchanger thermistor	100074281	EKK2T
412	Hi-Limit switch	100074280	EKN34
413	Overheat-cut-off fuse	100074334	EK333
414	Pipe heater	100074682	EK209
415	Inlet heater for Indoor model	100074683	EK210
	Inlet heater for Outdoor model	100074684	EK211
416	Drain tube	100074685	EK231
417	Inlet heater	100074629	EK105
418	Secondary heat exchanger for Indoor model	100074700	EK251
	Secondary heat exchanger for Outdoor model	100074701	EK256
450	Pipe heater fixing plate	100074273	EKK27
451	Heater fixing plate 16	100074310	EK031
452	Fuse fixing plate 18	100074251	EKK26
453	Fuse fixing plate 14	100074331	EK029
454	O-ring P4 FKM	100076303	EZM04
455	O-ring P6 FKM	100076305	EZM06
456	O-ring P14 FKM	100076306	EZM14
457	O-ring P15 FKM	100076307	EZM15
458	O-ring P16 FKM	100076308	EZM16
459	Fastener “4-11”	100074282	EKH30
460	Fastener “14-22”	100074290	EKK24
461	Fastener “16A”	100074410	EM192
462	Fastener “16-25A”	100074389	EKK39
463	Fastener “6-15”	100074297	EX12K
464	Flat heater	100074686	EK217
465	Drain tube	100276674	EK625
466	Cold pipe	100276640	EK624
467	Stainless heat exchanger out pipe	100074690	EK222
468	Header connection	100074691	EK226
469	Drain port	100074692	EK228
470	Thermistor fixing plate	100074291	EX13H
471	Exhaust thermistor gasket	100074296	EX13L
472	Hi-limit switch for exhaust	100074289	EKH6G
473	Gasket	100074693	EK229
701	Computer board	100276677	EK628
702	Rubber grommet	100076470	EX00B
703	Surge box	100076100	EK280
704	120 VAC wire for Indoor model	100074601	EK146
706	120 VAC Power ON-OFF switch	100074326	EKK4V
707	Remote controller wire	100074650	EK165
708	Gas valve wire	N/A	EK633
709	Flame rod wire	N/A	EK634
711	Igniter assembly	100276678	EK630

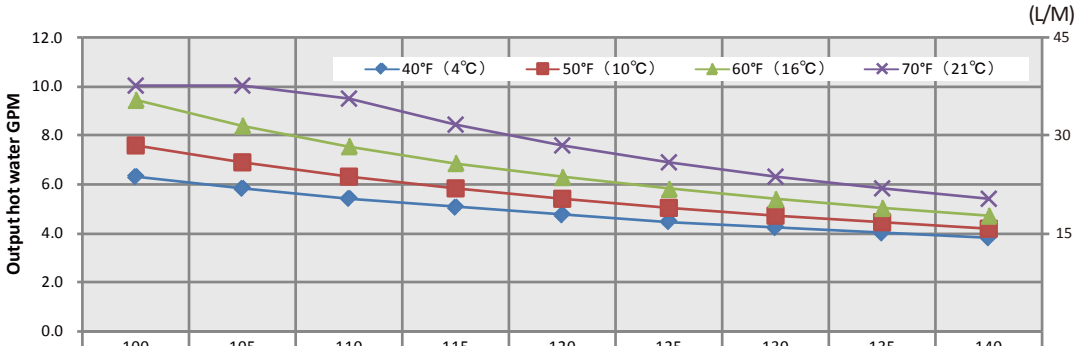
Item #	Description	Part #	
		540P	(AT-H3P)
713	Switch wire with thermostat for Indoor model	N/A	EK631
	for Outdoor model	N/A	EK636
714	Proportional gas valve wire	100074657	EK167
715	24V cables for Indoor model	N/A	EK632
	for Outdoor model	N/A	EK638
716	Computer board cover	100074375	EKK1M
717	Cable clamp	N/A	EX13C
718	Exhaust thermistor for Indoor model	100074316	EKH6E
719	Remote fixing plate	100074644	EK152
721	Exhaust Hi-limit switch wire	100074659	EK180
722	Temperature controller for Indoor model	100276680	EK639
723	Fixing plate	N/A	EK629
724	Temperature remote controller	100276687	TM-RE43
725	Pump fixing plate	N/A	EK619
726	Recirculation pump assembly	100276636	EK620
727	Pump inlet pipe	100276638	EK622
728	Pump outlet pipe	100276639	EK623
729	Pump connection	100276676	EK626
730	PCB fixing plate	N/A	EK627
731	Return thermistor	100276681	EK640
732	Closing plug	100276683	EK642
733	Three way connection	100276686	EK643
734	Heater	100076326	EK469
735	Fastner "12.7"	100076400	EM190

OUTPUT TEMPERATURE CHART

Chart is based on properly sized gas line.

540P model

Output Temperature vs. GPM (Max. 10.0 GPM) with Various Inlet Water Temperature



Incoming temp. °F(°C) \ Set temp. °F(°C)	100 (38)	105 (40)	110 (43)	115 (45)	120 (50)	125 (52)	130 (55)	135 (57)	140 (60)
40°F (4°C)	6.3 (23.9)	5.8 (22.0)	5.4 (20.4)	5.0 (19.1)	4.7 (17.9)	4.4 (16.8)	4.2 (15.9)	4.0 (15.1)	3.8 (14.3)
50°F (10°C)	7.6 (28.6)	6.9 (26.0)	6.3 (23.9)	5.8 (22.0)	5.4 (20.4)	5.0 (19.1)	4.7 (17.9)	4.4 (16.8)	4.2 (15.9)
60°F (16°C)	9.5 (35.8)	8.4 (31.8)	7.6 (28.6)	6.9 (26.0)	6.3 (23.9)	5.8 (22.0)	5.4 (20.4)	5.0 (19.1)	4.7 (17.9)
70°F (21°C)	10.0 (37.9)	10.0 (37.9)	9.5 (35.8)	8.4 (31.8)	7.6 (28.6)	6.9 (26.0)	6.3 (23.9)	5.8 (22.0)	5.4 (20.4)

*When the set temperature is 130 °F (55 °C) or higher, maximum flow rate is limited to 8.0 GPM.

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(REV. B)