



7. Air Intake Inlet and Exhaust Gas Outlet Pipe Connections

DANGER

Improper venting of the water heater results in excessive levels of carbon monoxide, which can lead to severe personal injury or death. This water heater must be vented in accordance with the “Venting of Equipment” section of the latest edition of the ANSI Z223.1 / NFPA 54 (Natural Fuel Gas Code) in the USA, or in Canada refer to the “Venting Systems and Air Supply for Appliances” section in the latest version of CAN/CGA B149.1 (Natural Gas and Propane Installation Code), and all applicable local building codes. Vent installation should be performed only by a licensed professional.

 **WARNING**

 **BREATHING HAZARD
CARBON MONOXIDE GAS**

- Do not operate flood-damaged water heaters.
- Install venting system according to the required codes and material manufacturers specifications.
- Do not obstruct fresh air intakes or exhaust outlets. Adequately support all vent system piping.
- Do not place vapor-emitting products near water heater or air intake.
- Place working carbon monoxide detectors outside each sleeping area.
- Do not operate the water heater before properly installing the exhaust outlet.
- Inspect the vent system and eliminate any possible area where condensation could create a blockage of intake or exhaust air.

Breathing concentrated levels of carbon monoxide, even for a short period, causes brain damage and can even lead to death.

Note: This water heater falls into the Category IV appliance.

7.1 Quick Reference Installation Guide

1. Select the desired type of venting system: Two Pipe Vent System (Direct) or Single Pipe Vent System (Power).
 - “7.3 Two Pipe Vent System (Direct Vent)” on page 21.
 - “7.4 Single Pipe Venting System” on page 23.
2. Select the desired termination of the air intake inlet and exhaust gas outlet pipe: outside wall or roof.
 - “7.3.3 Side Wall Air Intake Inlet and Exhaust Gas Outlet Pipe Termination” on page 22.
 - “7.3.4 Roof Air Intake Inlet and Exhaust Gas Outlet Pipe Termination” on page 23.

3. Determine the straight line distance and the number of elbows required to route the air intake inlet and exhaust gas outlet pipes to their termination point.
See “7.6 Intake Air Inlet and Exhaust Gas Outlet Pipe Diameter and Length” on page 25.
4. Determine the diameter of pipe required to properly bring in intake air and vent exhaust gas.
See “7.6 Intake Air Inlet and Exhaust Gas Outlet Pipe Diameter and Length” on page 25.
5. Verify that the location of the air intake inlet and exhaust gas outlet terminations are within state and local codes.
See “7.7 Venting Clearance Specifications” on page 26.
6. Select an approved material for the air intake inlet piping.
See “7.8 Exhaust Gas Outlet Pipe Materials” on page 27.
7. Select an approved material for the exhaust gas outlet piping.
See “7.9 Air Intake Inlet Pipe Vent Materials” on page 27.

7.2 Typical Single Unit Air Intake Inlet and Exhaust Gas Outlet Pipe Installation

1. Select one of the following two venting configurations:
 - Two pipes (direct vent) configuration
 - One pipe (power vent) configuration
2. Select the desired termination location and make sure each pipe terminates according to all local and state codes.
3. Select the desired material for the air intake inlet and exhaust gas outlet pipes.

CAUTION

This water heater has a factory preset control to limit the exhaust gas temperature to 149°F (65°C) when the PVC is selected in the “Flue Type” programming section. As a result, the water heater can be vented with Schedule 40 PVC. If the incoming (or recirculation return) water temperature does not exceed 150°F (66°C), the exhaust gas temperature does not exceed 149°F (65°C).

WARNING

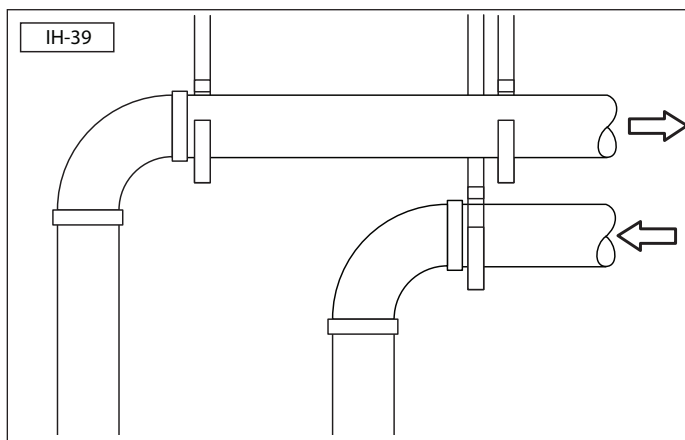
When the unit is set for CPVC (polypropylene pipe), flue temperatures can reach 190°F (88°C). PVC pipe melts at temperatures above 149°F (65°C) and could therefore result in a fire. Make sure the setting and the type of material being used for the flue are compatible.

For this application, use Schedule 80 CPVC or Approved Polypropylene in the USA or Type BH Special Gas Vent Class IIB (CPCV) or Class IC (Polypropylene) that conforms to ULC-S636 in Canada.

SAFETY INSTRUCTIONS

On multiple unit installations, the air intake inlet and exhaust gas outlet piping from each water heater must be connected into the properly-sized common piping. Use the table in “7.6 Intake Air Inlet and Exhaust Gas Outlet Pipe Diameter and Length” on page 25 to determine the diameter of the common connecting piping between each individual water heater.

4. Determine the length and corresponding diameter for the air inlet pipe and route the pipe to the desired termination location.
 - a. For termination of the pipe to the outside, continue installing the required pipe to a suitable outside location. Glue all connections, making sure the joints are sealed airtight.
 - b. Install suitable pipe support hangers every 4 to 5 feet, or as local building codes require.



- c. To configure the unit for power vent, insert a 3' section of 3" pipe.
5. Determine the length and corresponding diameter for the exhaust gas outlet pipe and route it to a suitable outside location.
 - a. Glue all connections, making sure the joints are sealed airtight.
 - b. Install all horizontal exhaust gas outlet piping with a minimum 2 degree (1/4" per foot) slope back toward the water heater. This allows any condensate that accumulates in the exhaust gas outlet pipe to properly drain back into the unit.
 - c. Install suitable pipe support hangers every 4 to 5 feet, or as local building codes require.

SAFETY INSTRUCTIONS

Do not connect any other appliance vents to the water heater inlet or outlet pipes.

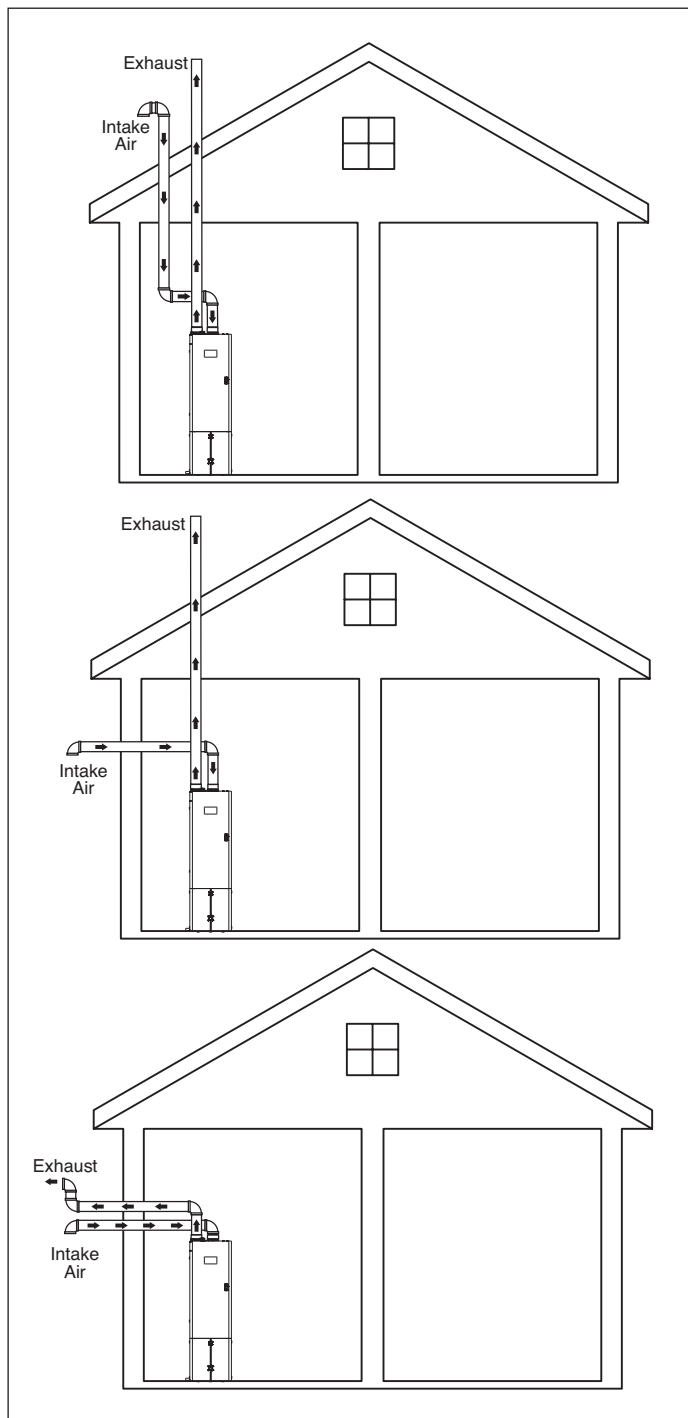
6. If multiple units are installed, make sure the diameter of the connecting exhaust gas outlet pipe is properly sized for the number of units being installed.

7.3 Two Pipe Vent System (Direct Vent)

7.3.1 Single Unit Configurations

The water heater can be directly vented without any modification using a 3-inch diameter pipe.

The following diagrams represent some typical direct venting configurations and are included to assist in designing the vent system. Possible configurations are not limited to the following diagrams.

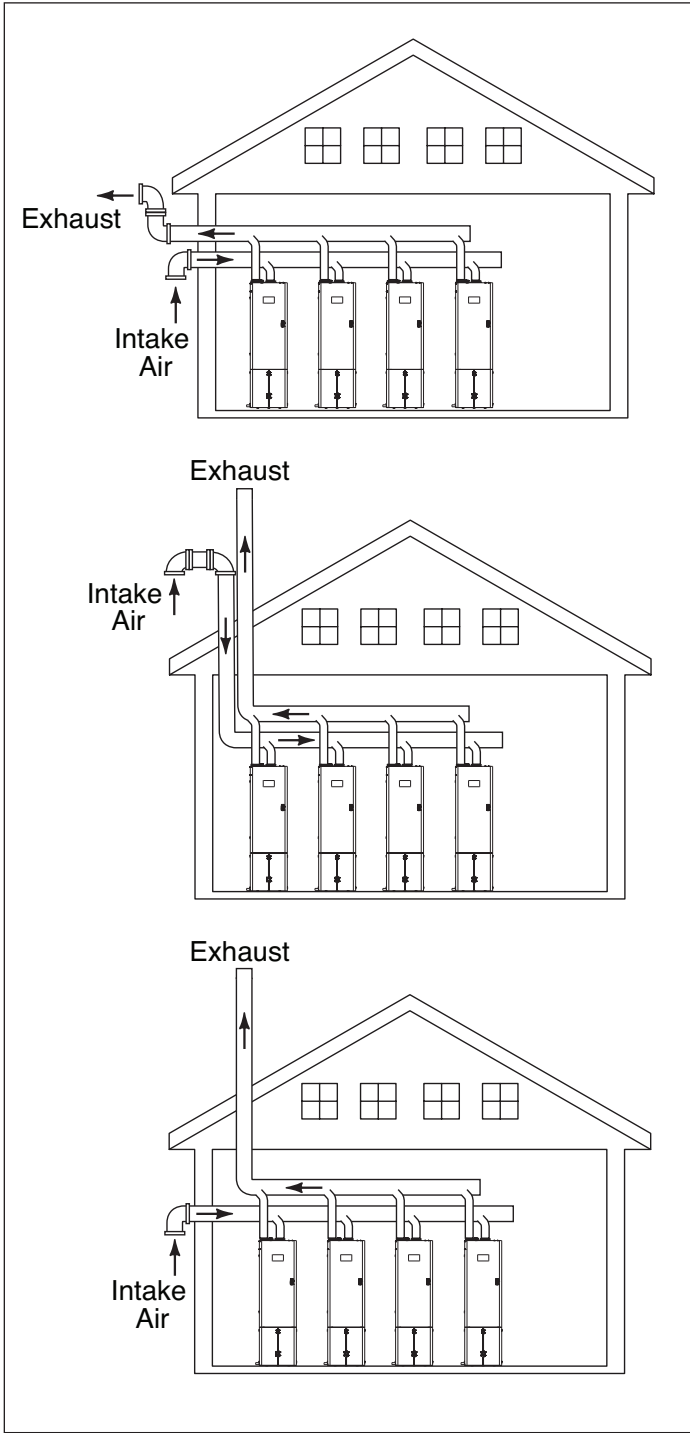


7.3.2 Multiple Units Configurations

When more than one unit is installed, refer to “7.6 Intake Air Inlet and Exhaust Gas Outlet Pipe Diameter and Length” on page 25.

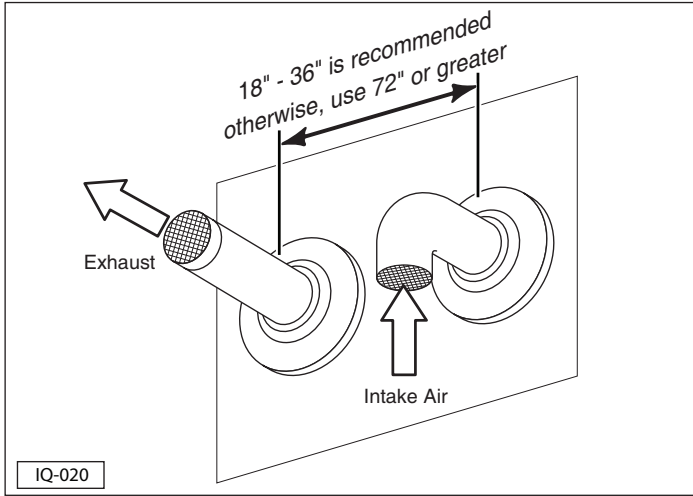
Connecting multiple units together requires proper sizing of the air intake inlet and exhaust gas outlet pipes. Up to four water heaters can be cascaded together. Units which share a common vent must be connected together in a cascading configuration, as described in “13. Connecting Multiple Units” on page 48.

The following diagrams represent some typical direct venting configurations and are included to assist in designing the vent system. Possible configurations are not limited to the following diagrams.

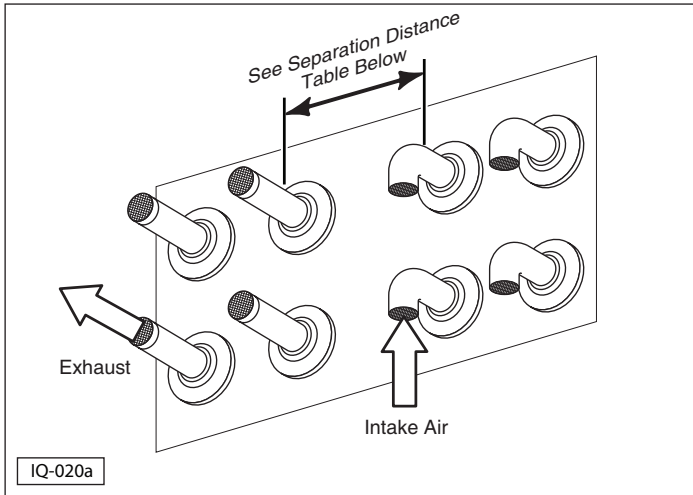


7.3.3 Side Wall Air Intake Inlet and Exhaust Gas Outlet Pipe Termination

- 1. Terminate the air intake inlet pipe with a 90° elbow (angled down). Use a flange and PVC screen (not supplied).
- 2. Terminate the exhaust gas outlet pipe on the exterior wall at least 12" above ground and at least 18" away from the air intake inlet pipe, or as required by local building codes. In areas of high snow fall, protect the vent terminations from blockage. Use a flange and PVC guard.



Single unit.



Multiple units.

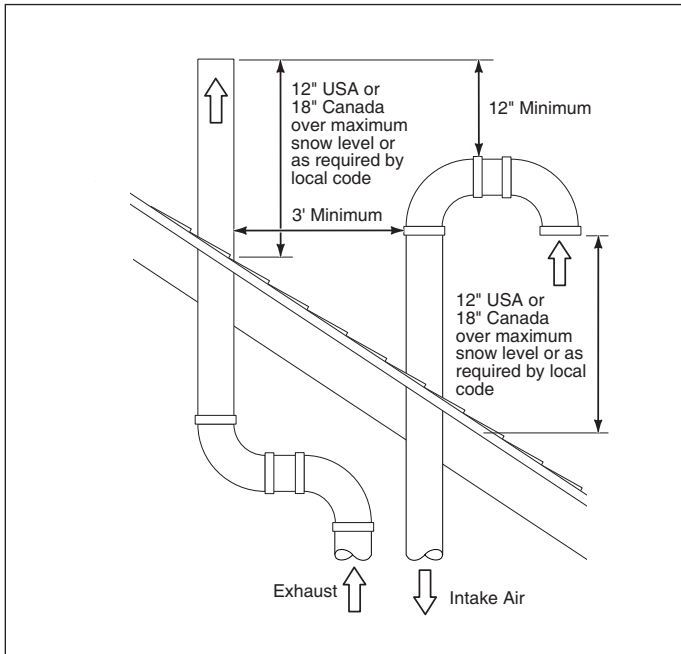
Separation Distance	Status
0 - 17.9"	Not Allowed
18" - 36"	Allowed
36.1" - 71.9"	Not Allowed
72" or greater	Allowed

- 3. To avoid moisture and frost build-up to openings on adjacent structures, use 45° elbows, 90° elbows, or tees for the vent termination to direct the exhaust gas fumes away from the building.

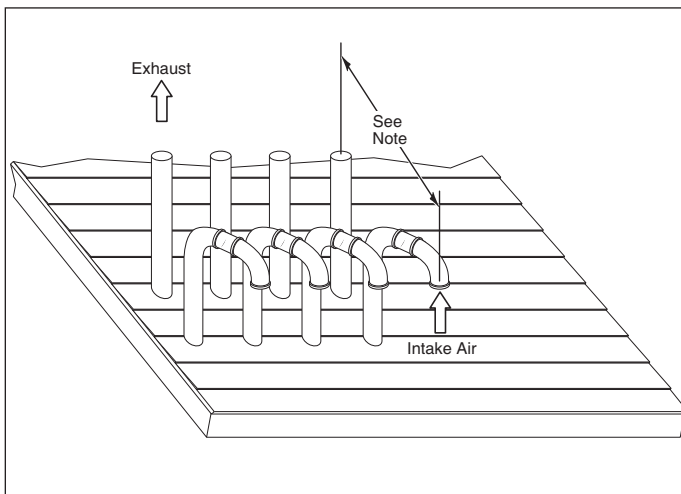
7.3.4 Roof Air Intake Inlet and Exhaust Gas Outlet Pipe Termination

With this installation method, the terminations must extend at least 12 inches over maximum potential snow levels, or as required by local building codes. In areas of high snow fall, protect the vent terminations from blockage.

Terminate the air intake inlet pipe with a 90° elbow (angled down). A suitable roof flashing and vent cap (not supplied) should be installed.



Single unit.



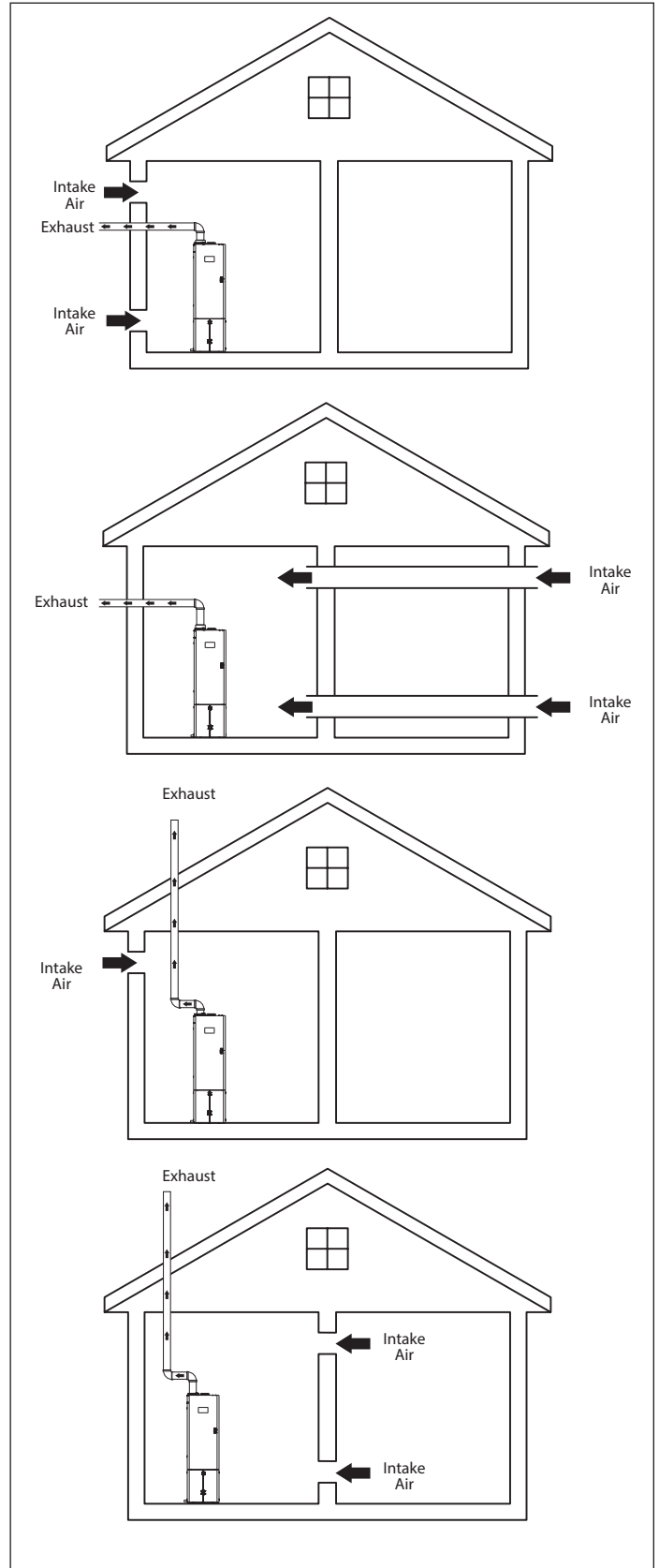
Multiple units.

Note: The distance between any exhaust gas outlet and air intake inlet pipe should be between 18 and 36 inches apart. If this minimum specification cannot be met, the air intake inlet and exhaust gas outlet pipes should be 72 inches apart or more.

7.4 Single Pipe Venting System

7.4.1 Single Unit

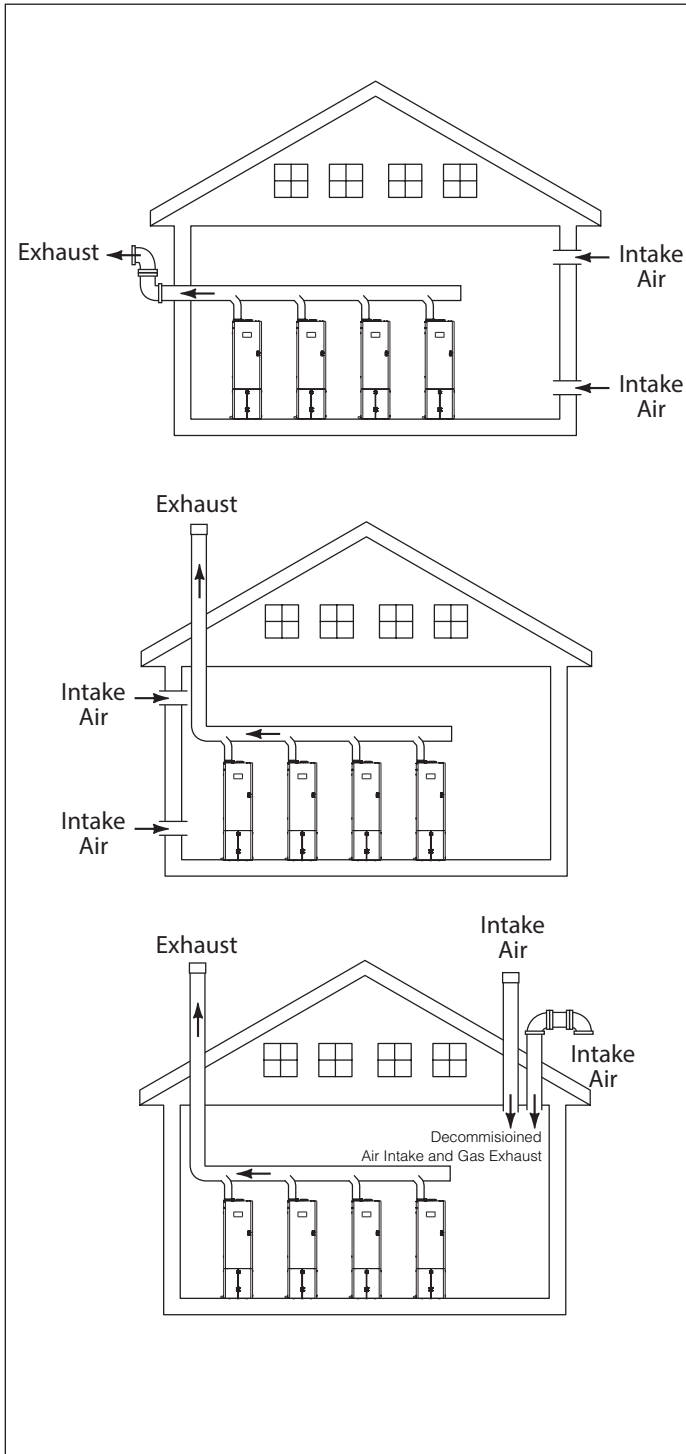
The following illustrations represent some typical venting configurations and are included to assist in designing the vent system. Possible configurations are not limited to these designs.



7.4.2 Multiple Units

When installing multiple units, refer to “7.6 Intake Air Inlet and Exhaust Gas Outlet Pipe Diameter and Length” on page 25.

Connecting multiple units together requires proper sizing of the air intake inlet and exhaust gas outlet pipes. Up to four water heaters can be cascaded together. Units which share a common vent must be connected together in a cascading configuration, as described in “13. Connecting Multiple Units” on page 48



7.5 Combustion Air Requirements

When using the single exhaust gas outlet pipe or vent method, the following table outlines the required opening sizes for the combustion and ventilation air coming into the room and the required CFM requirements per water heater:

SAFETY INSTRUCTIONS

Do not operate the unit in an area that draws in outside air contaminated with high levels of dust, sawdust, aerosols such as paint, or other airborne contaminants.

If necessary, purchase and install appropriate air screens and follow a regular cleaning program to ensure an adequate supply of clean, outside combustion air.

Required Combustion & Ventilation Air Opening Sizes (sq. in) Per Heater Per Boiler Room:							
Model	Input	Air Type	Required CFM	Air is drawn directly from outside into the mechanical room			Air is drawn from another interior space inside the building
				Through two openings*, direct or vertical	Through one opening**	Through two horizontal ducts	
iN199/iN199A	199,950	Combustion Air	36	50	63	100	67
		Ventilation Air	36	50		100	67
iN251	251,000	Combustion Air	46	63	84	125	84
		Ventilation Air	46	63		125	84

*Where two openings are used, one must be within 12 inches of the floor and the other opening must be within 12 inches of the ceiling of the mechanical room.
 **Where one opening is required, it must be located within 12 inches of the ceiling.

7.6 Intake Air Inlet and Exhaust Gas Outlet Pipe Diameter and Length

The iN199 comes factory installed with 3-inch polypropylene (PP) venting. The following chart outlines the maximum length of venting allowable for each model.

A vent system's length is calculated by adding the length of all straight runs used (both horizontal and vertical) and then adding the equivalent lengths of each turn (90° or 45° elbow) used in the system.

SAFETY INSTRUCTIONS

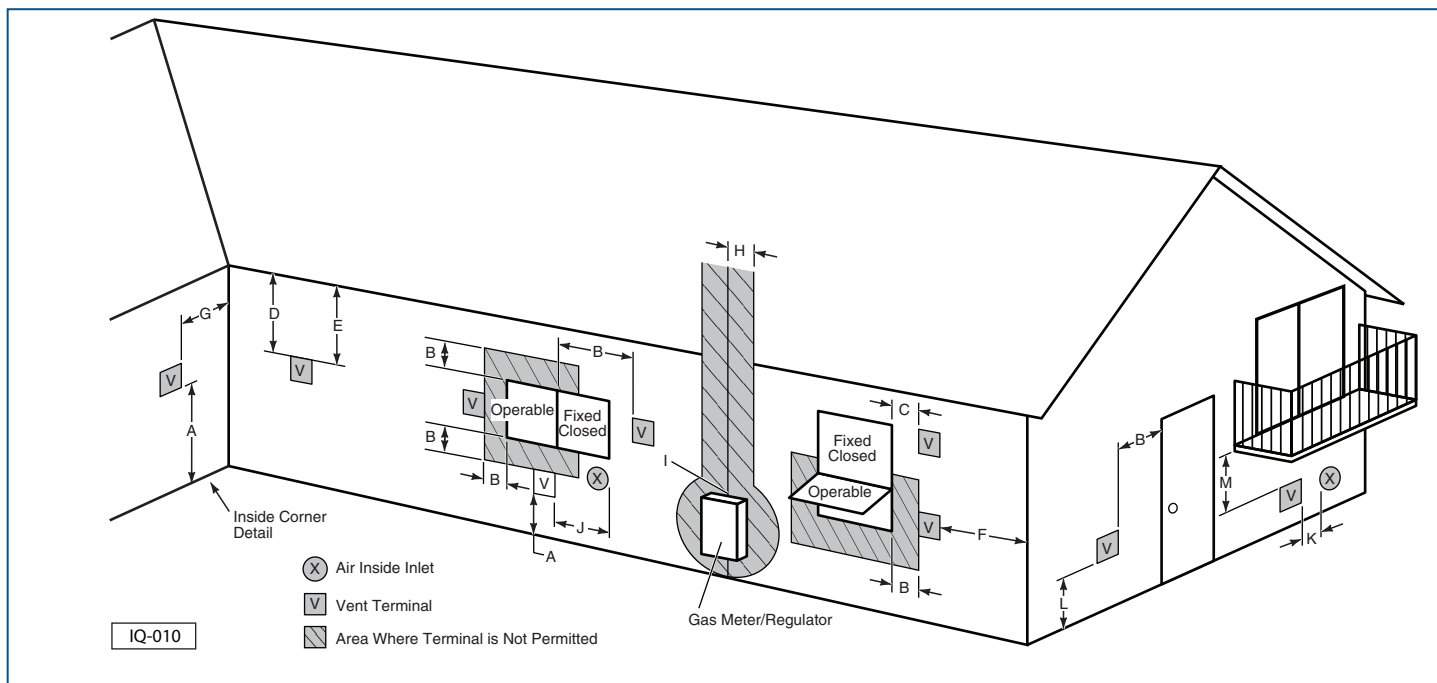
A vent system's length must not exceed the maximum length outlined in the chart below.

Maximum Pipe Length in Feet									
Number of Units	Venting Type	Diameter, Model, and Length in Feet							
		3" Diameter		4" Diameter		6" Diameter		8" Diameter	
		iN199/ iN199A	iN251	iN199/ iN199A	iN251	iN199/ iN199A	iN251	iN199/ iN199A	iN251
1	1 pipe	195	130	250	200	250	200	250	200
	2 pipe	95	65	125	100	125	100	125	100
2	1 pipe	55		228	150	250	200	250	200
	2 pipe	28		114	75	125	100	125	100
3	1 pipe			110	70	250	200	250	200
	2 pipe			55	35	125	100	125	100
4	1 pipe					250	200	250	200
	2 pipe					125	100	125	100

Note:

- 1 Pipe - Only exhaust-out pipe is connected and the combustion air intake is from within the room. For example, one iN199 with a 3" diameter, the maximum exhaust pipe length for 1 pipe is 195 feet.
- 2 Pipe - Both the combustion air intake and the exhaust pipe are connected. In this case, the table specifies the maximum length per pipe. For example, one iN199 with 3" diameter, 95 feet maximum is allowed for combustion air intake pipe and exhaust-out pipe. The 95 feet maximum is per pipe.
- Reduce the maximum equivalent length above by 5 feet per 90° elbow used and by 2 feet per 45° elbow used. Do not exceed the above set limits.
- If Multiple units are common-vented, then the units must be cascaded. Refer to section "7.5 Combustion Air Requirements" on this page for how to do combustion with common-vented units.

7.7 Venting Clearance Specifications



Venting Clearance Specifications			
Item	Description	Clearance Distance	
		USA ¹	Canada ²
A	Clearances above grade, veranda, porch, deck, or balcony	1 foot	1 foot
B	Clearances to window or door that can be opened	1 foot**	3 feet
C	Clearances to permanently closed window	*	*
D	Vertical clearance to a ventilated soffit, eaves, or overhang	*	*
E	Clearances to unventilated soffit, eaves, or overhang	*	*
F	Clearances to outside corner	*	*
G	Clearances to inside corner	*	*
H	Clearances to each side of centerline extended from meter/regulator	*	3 feet within a height 15 feet above meter/regulator assembly
I	Clearances to gas meter regulator vent outlet	*	3 feet
J	Clearances to non-mechanical air supply inlet or combustion air inlet to any other appliance	1 foot**	3 feet
K	Clearances to mechanical air supply inlet	3 feet above if within 10 feet horizontally	6 feet
L	Clearances above paved sidewalk or paved driveway on public property	*	7 feet
M	Clearances under veranda, porch, deck, or balcony	*	1 foot
<p>*Per local/gas supplier codes. Use clearances in accordance with local building codes and local gas supplier.</p> <p>** For single vent pipe/direct 4 feet (1.2 m) below or to the side of opening and 1 foot above opening.</p> <p>¹ In accordance with Z223.1</p> <p>² In accordance with CSA B149.1</p>			

Note:

The vent for this appliance shall not terminate:

- Over public walkways
- Near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage
- Where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment

7.8 Exhaust Gas Outlet Pipe Materials

SAFETY INSTRUCTIONS

For Canadian installations, plastic exhaust gas outlet piping must comply with CAN/CGA B149.1 and be certified to the Standard For Type BH Gas Venting Systems, ULC-S636. Components of this listed system must not be interchanged with other vent systems or unlisted pipes or fittings. All plastic components and specified primers and glues must be from a single system manufacturer and must not be intermixed with another system manufacturer's products.

All units come factory installed with 3-inch polypropylene (PP) venting. A polypropylene-to-PVC adapter is included with each unit to enable the use of PVC exhaust gas outlet pipe. The maximum allowable venting distances are the same regardless of vent material selected.

The materials listed in the tables below outline the acceptable exhaust gas outlet pipe materials:

United States Exhaust Gas Outlet Pipe Standards	
Material	Description*
Exhaust Gas Outlet Pipe	PVC Schedule 40 (ASTM D1785)
	CPVC Schedule 80
	Approved Polypropylene
	AL29-4C Stainless Steel

Canadian Exhaust Gas Outlet Pipe Standards	
Material	Description (approved to ULC-S636)**
Exhaust Gas Outlet Pipe	Type BH Special Gas Vent Class IIA (PVC)
	Type BH Special Gas Vent Class IIB (CPVC)
	Type BH Special Gas Vent Class IIC (Polypropylene)
	Type BH Special Gas Vent Class I (AL29-4C Stainless Steel)
<p>*Note: Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel (polyphenylsulfone) in nonmetallic venting systems is prohibited. Covering nonmetallic vent pipe and fittings with thermal insulation is prohibited.</p> <p>**Note: The components (pipe, fittings, primers, and glues) must be from a single manufacturer; do not interchange. Follow the vent manufacturer's certified instructions.</p>	

SAFETY INSTRUCTIONS

Do not use cellular foam core pipe to vent exhaust gases.

This water heater has a built-in exhaust gas outlet temperature control that limits the exhaust gas temperature to a maximum of 149°F (65°C) for PVC pipe. In commercial applications which require higher water temperatures, exhaust gas temperature can reach 190°F (88°C) and require materials such as polypropylene (PP), stainless steel (SS), or CPVC.

If the temperature approaches the upper limit, the burner turns off automatically to protect the vent pipe. After the exhaust gas temperature has dropped to a normal operating level, the unit automatically restarts.

If the inlet/return water temperature exceeds 150°F (66°C), do not use PVC pipe. Follow the display prompts to set the maximum water temperature for the exhaust-gas outlet pipe material being used.



7.9 Air Intake Inlet Pipe Vent Materials

The air intake inlet pipe can be of any plastic or metal vent material available. ABS, PVC, polypropylene, galvanized steel, and/or flexible corrugated ducting are all examples. When using a corrugated material, ensure there is no inadvertent crimping or blockage to the air intake inlet pipe.

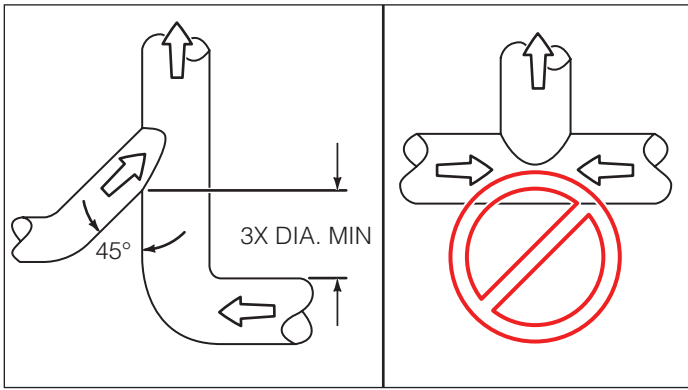
Refer to the tables below for a list of approved materials.

United States Vent Pipe Standards	
Material	Description
Vent Pipe	PVC Schedule 40
	CPVC Schedule 80
	Approved Polypropylene

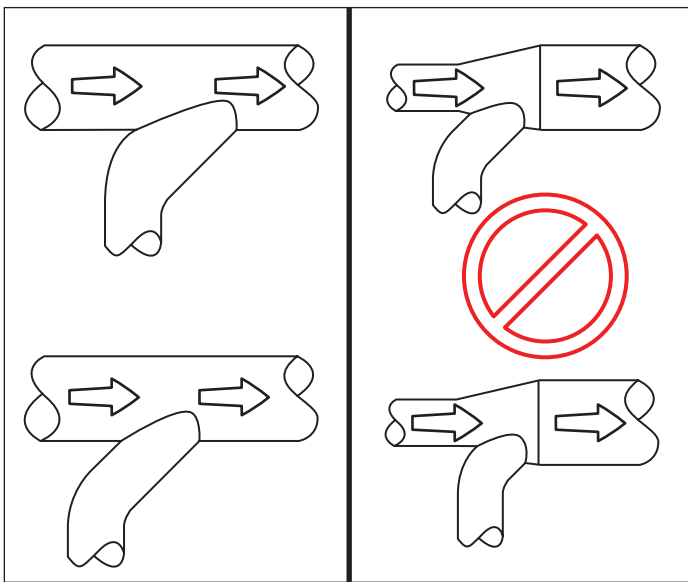
Canadian Vent Pipe Standards	
Material	Description
Vent Pipe	Type BH Special Gas Vent Class IIA (PVC)
	Type BH Special Gas Vent Class IIB (CPVC)
	Type BH Special Gas Vent Class IIC (Polypropylene)

Note: In addition to these charts, it is recommended to consult the most recent edition of ANSI Z223.1/NFPA 54 or CAN/CGA B149.1, as well as all applicable local codes and regulations when selecting vent pipe materials.

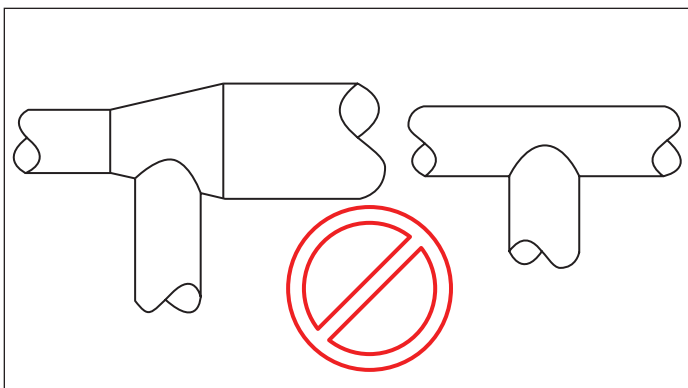
7.10 Recommended Exhaust-Gas Outlet Pipe Transitions



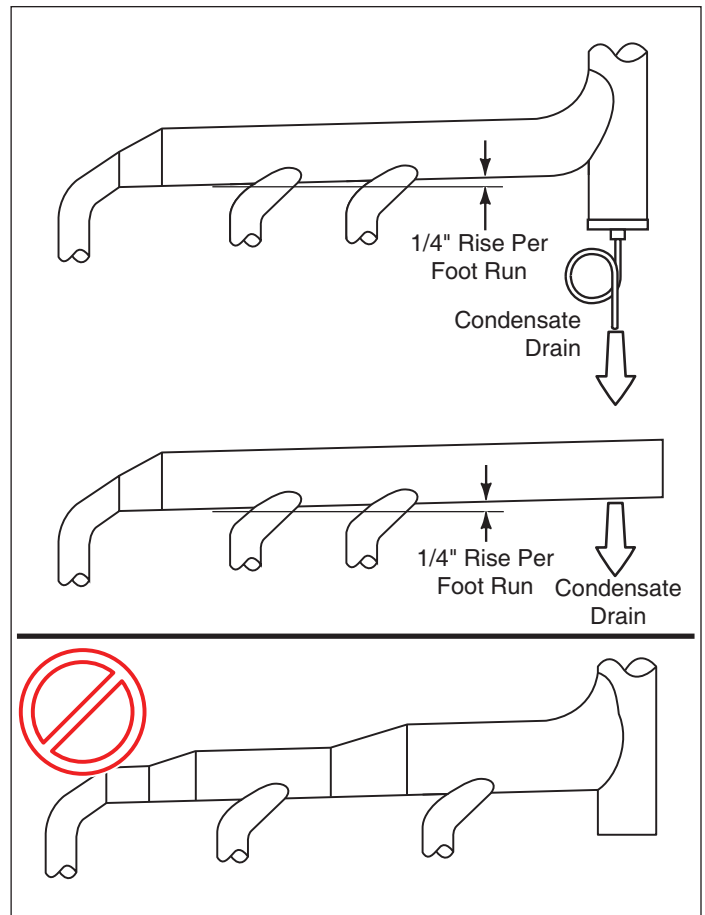
Do not direct exhaust gas from opposite directions. Use a 45 degree transition, as shown.



Do not transition into a reducer or use a t-fitting. Transitions should always be directed into a straight run of pipe.



Do not use 90 degree transition into a reducer or a straight pipe.



Do not use reducers in a straight run of pipe.