

3. Technical Specifications

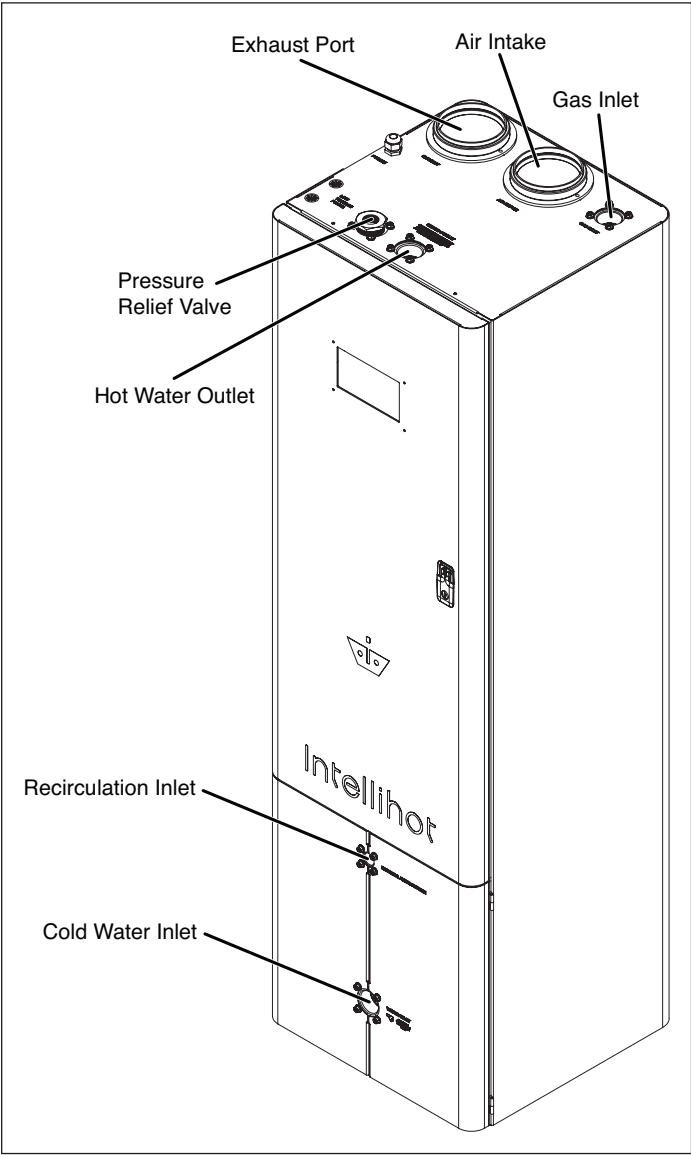
3.1 Specifications Chart

Technical Data	iN199	iN199A	iN251
Type	Indoor, Floor-Mounted		
Fuel	Preset for natural gas but convertible to propane		
Minimum Input (BTUs/hour)	30,000		
Maximum Input (BTUs/hour)	199,950	251,000	
Maximum Output (BTUs/hour)	195,950	240,960	
Thermal Efficiency	98%	96%	
Turn Down Ratio (TDR)	6.7:1	8.4:1	
Water Inlet / Outlet Connection	1-1/2" NPT		
Gas Inlet Connection	1-1/2" NPT (3/4" w/nipple)		
Condensate Drain Connection	3/4" PVC		
Maximum Condensate Flow Rate (GPH)	1.4	1.8	
Unit dimensions H X W X D (inches)	67.5 X 20 X 20 (15.6 cu. ft)		
Service Clearances	4" on the back, 6" on the top, 21" on the front, and 6" on the sides		
Unit weight (lbs)	273		
Shipping Crate Dimensions H X W X D / Weight	27 X 29.5 X 85 (Inches) / 373 (LBS)		
Venting Type	Direct Vent (2 pipe – air intake and exhaust gas outlet), Power Vent (1 pipe – exhaust gas only)		
Venting Materials (USA)	Sch. 40 PVC, Sch. 80 CPVC, Polypropylene, Stainless Steel (AL29-4C)		
Venting Materials (Canada)	Type BH Gas Vent Classes: II A (PVC), II B (CPVC), II C (Polypropylene), I (AL294C SS)		
Venting Size (Diameter)	3"		
Max 3" Vent Length – Single Pipe/Power Vent	195' *	130' *	
Max 3" Vent Length – Two Pipe / Direct Vent	95' *	65' *	
* Venting Note: From the maximum length above, deduct 5 ft. per 90° elbow and 2 ft. per 45° elbow.			
Ignition	Electronic Spark Ignition		
Temperature Range	100°F – 190°F		
Temperature Stability	+/- 4°F (when on demand)		
Installation Location Ambient Temperature	40°F – 130°F		
Safety	Flame Rod, Thermal Fuse, Overheat Prevention Device, Fan Speed Monitor, Flue Temperature Monitor, Blocked Vent Detector, Dual Flame Sensing		
Water Pressure Min / Max (PSI)	30/150	30/160	
NG/LP- Min. Static Gas Pressure (Full Fire)	NG = 2.5" WC LP= 8" WC (set Gas regulator to 8" WC for NG 11" WC for LP)		
NG/LP - Maximum Static Gas Pressure	14" WC (set Gas regulator to 8" WC for NG 11" WC for LP)		
Gas Pressure for Adjustments	8" WC for Natural Gas, 11" WC for Propane		
Electrical	120V AC, 60 Hz		
Power Consumption	Max 9.5 Amps, 16W (Standby)		
Internal Water Volume (gallons)	1		
Warranty	Heat Engine Coil - 6 years, All Other Parts - 1 year		
Note: Due to continuous product improvements, the design and technical specifications are subject to change without notice.			

Specifications Chart

Technical Data	iN199	iN199A	iN251
Features and Approvals			
Cascading	Masterless, 4-Unit, Automatic Rotation		
Common Venting	Yes, Up to 4 Units		
Heat Exchanger	Expandable, Stainless 316L		
Appliance Certification to ANSI Z21.10.3	ETL (Z21.10.3 / CSA 4.3)	ETL (Z21.10.3 / CSA 4.3), ASME HLW	
SCAQMD	Ultra Low Nox (under 20 PPM)		Pending
Performance	iN199/iN199A		iN251
Hot Water Output (45°F Rise) (GPM)	8.7		10.8
Hot Water Output (70°F Rise) (GPM)	5.6		6.9
Hot Water Output (90°F Rise) (GPM)	4.4		5.4
Hot Water Output (100°F Rise) (GPM)	3.9		4.8
Hot Water Output (140°F Rise) (GPM)	2.8		3.5
Warranty	Heat Engine Coil - 6 years, All Other Parts - 1 year		
Note: Due to continuous product improvements, the design and technical specifications are subject to change without notice.			

3.2 Nomenclature

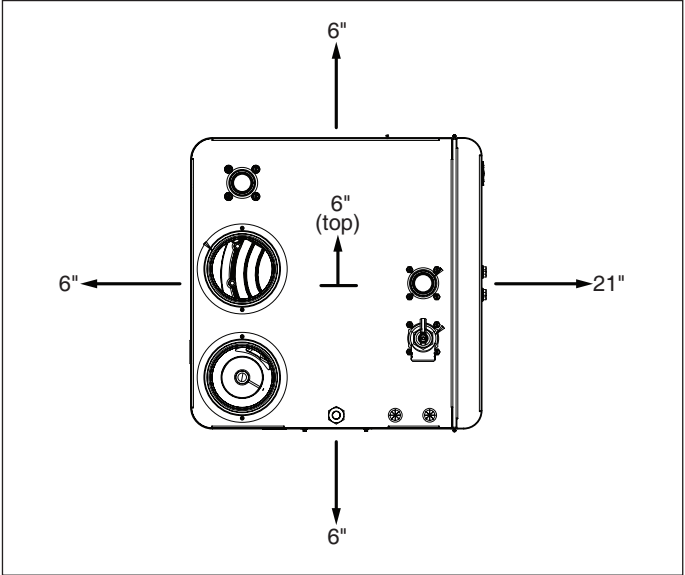


3.3 High Elevation Installations

For operation at elevations above 2,000 feet, the hot water delivery capacity should be reduced by 4% for each 1,000 feet above sea level.

Clearance Requirements

For the water heater to operate properly and efficiently, the clearances specified in the table below are recommended.



Service Clearances: If multiple units are installed, complete the electrical connections first before making all other connections (gas, water, supply air, exhaust, and condensate). This enables the 1" side to side clearances mentioned in 3.1 Specifications Chart.

Location	Required		Recommended
	From Combustibles	From Non-Combustibles	
Top	6" (15 cm)	2" (51 cm)	6" (15 cm)
Back	5/8" (16 mm)	5/8" (16 mm)	4" (10 cm)
Sides	1" (25 mm)	1/2" (13 mm)	6" (15 mm)
Front	2" (5 cm)	2" (5 cm)	21" (53 cm)
Bottom	0" (0 mm)	0" (0 mm)	0" (0 mm)

¹ Service clearances are the minimum required clearances to ensure the unit's ease of servicing

3.4 Connection Specifications

Connections	
Description	Specification ²
Gas Supply Inlet Connection	3/4" NPT
Water Supply Inlet Connection	1-1/2" NPT
Heated Water Outlet Connection	1-1/2" NPT
Exhaust Gas Vent ¹	3" Polypropylene
Air Intake Inlet ¹	3" Polypropylene
Condensate Drain Connection	3/4"
Power Supply	120V AC Power

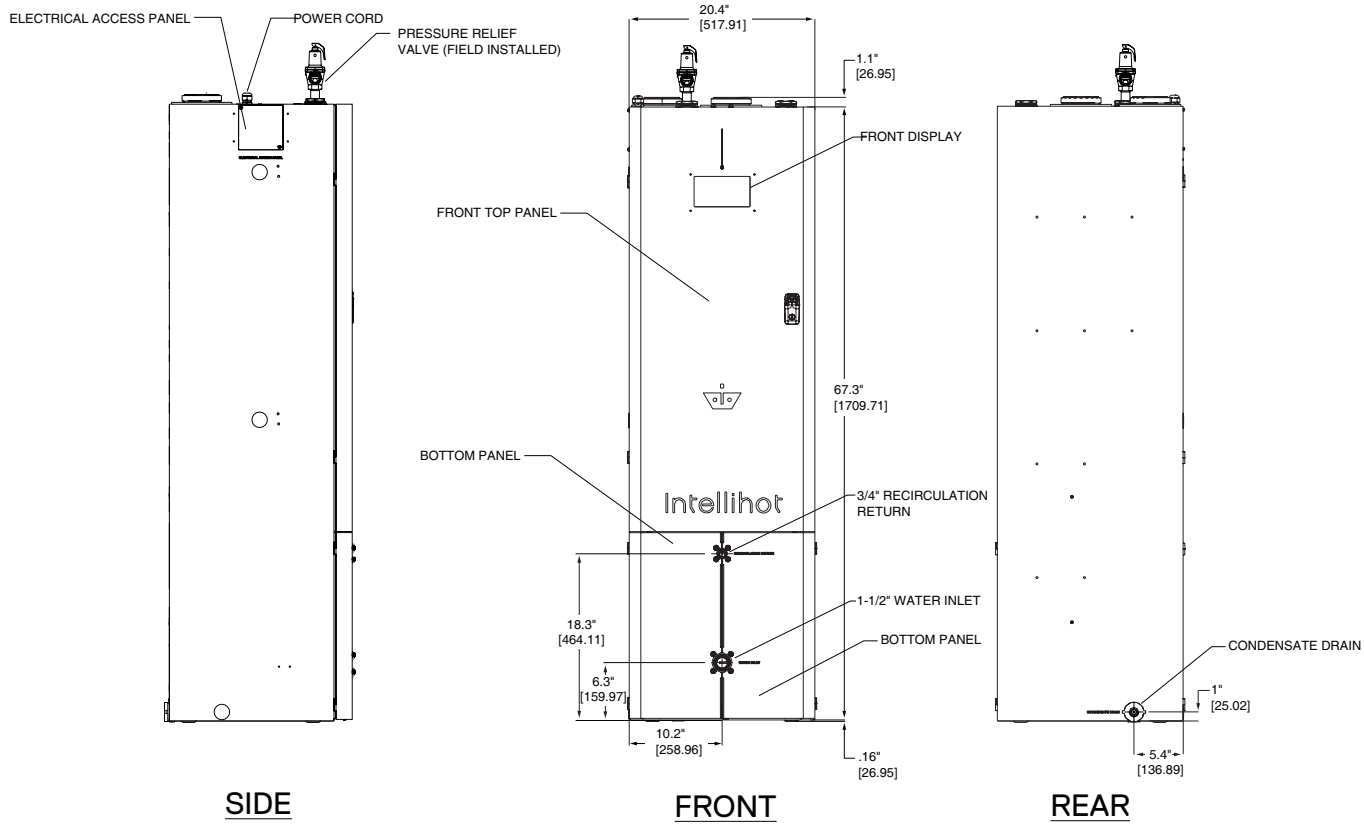
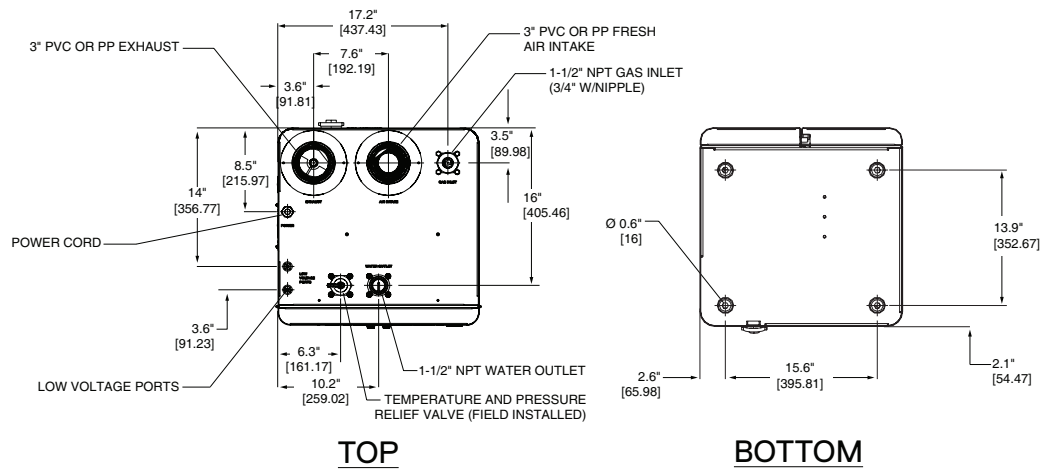
¹ Use the 3" adapter provided when using PVC or CPVC pipe.

² Using sizes other than specified can cause damage to the water heater and will void the warranty.

3.5 Exhaust Gas Standards

CO ₂ and CO Standards		
Description	CO ₂ Range (%)	Max. CO Level Particles Per Million (ppm)
Natural Gas		
High Fire	9.1% to 9.3%	< 200 ppm
Low Fire	9.1% to 9.3%	< 60 ppm
Propane Gas		
High Fire	10.1% to 10.5%	< 200 ppm
Low Fire	10.1% to 10.5%	< 60 ppm

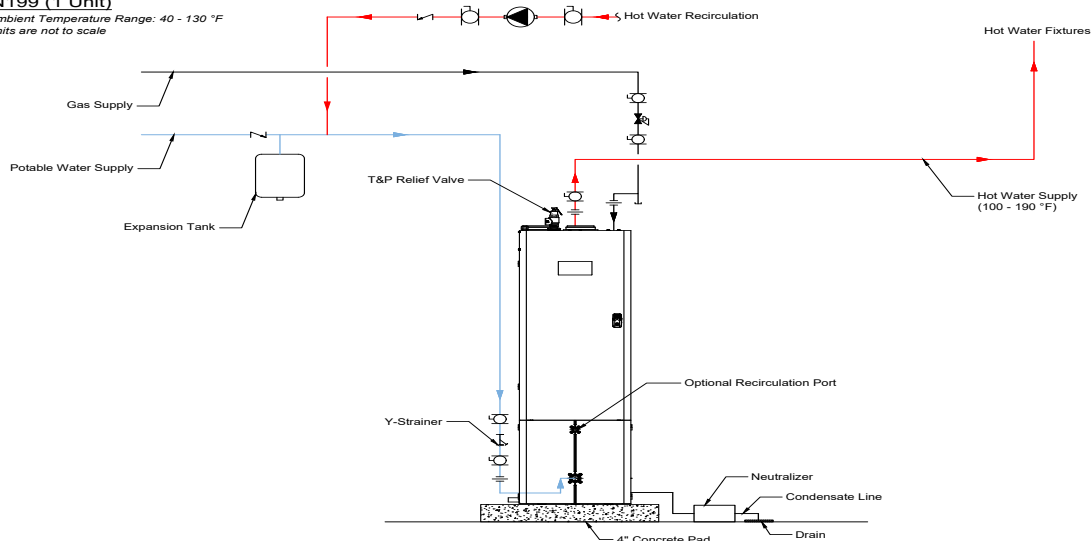
3.6 Overall Dimensions



3.7 Configuration Options

iN199 (1 Unit)

Ambient Temperature Range: 40 - 130 °F
Units are not to scale



LEGEND	
	T&P Relief Valve
	Isolation Valve
	Check Valve
	Pipe Coupling
	Sediment Trap
	Recirculation Pump
	Gas Pressure Regulator

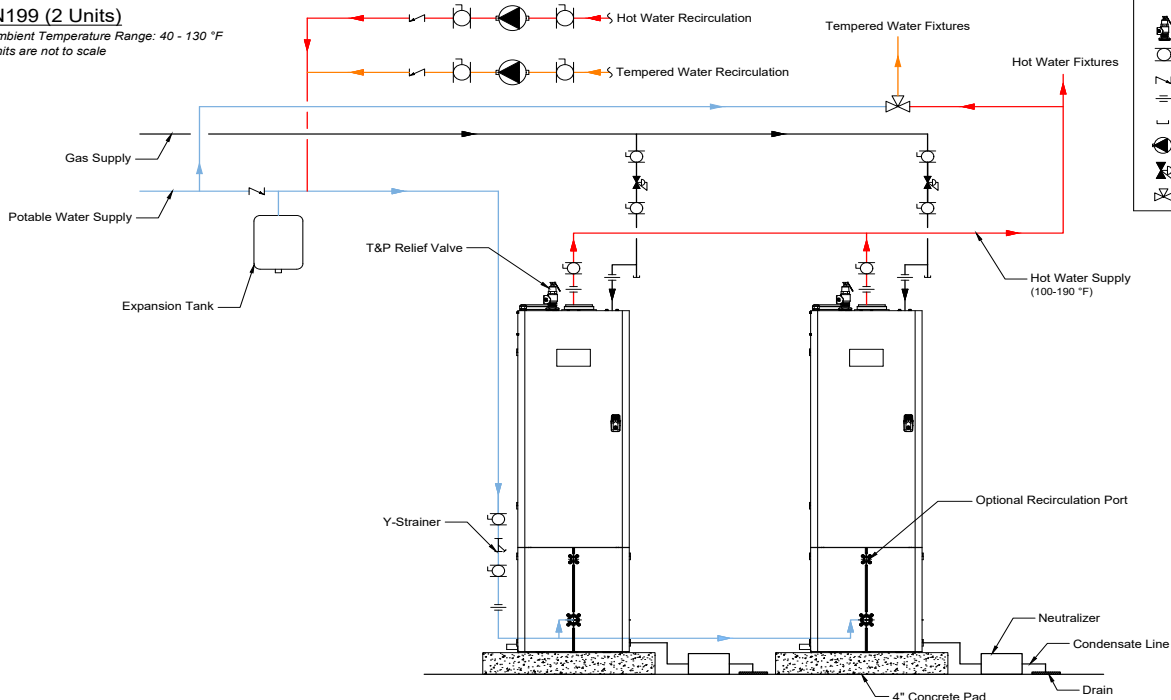
NOTES:

1. This schematic is a suggested piping diagram. Any additional requirements from local codes and ordinances shall supersede this diagram.
2. Units are not to be installed in a closed loop system. Our gas fired units are HLW stamped.
3. For pipe sizes and gas pressure requirements, please refer to the operation and installation manual.
4. Gas pressure regulators to be installed for each unit. Follow manufacturer's installation instructions.
5. Water hammer arrestor comes installed in the units.
6. Y-strainer to be installed according to manufacturer's instructions, horizontal or vertical preferred.
7. Temperature and pressure relief valve (shipped with the unit) to be installed on the top hot water port.
8. Expansion tank to be sized based on the gallons of water in the plumbing system and to be installed per manufacturer's instruction.

System with no storage tank and without mixing valve.

iN199 (2 Units)

Ambient Temperature Range: 40 - 130 °F
Units are not to scale

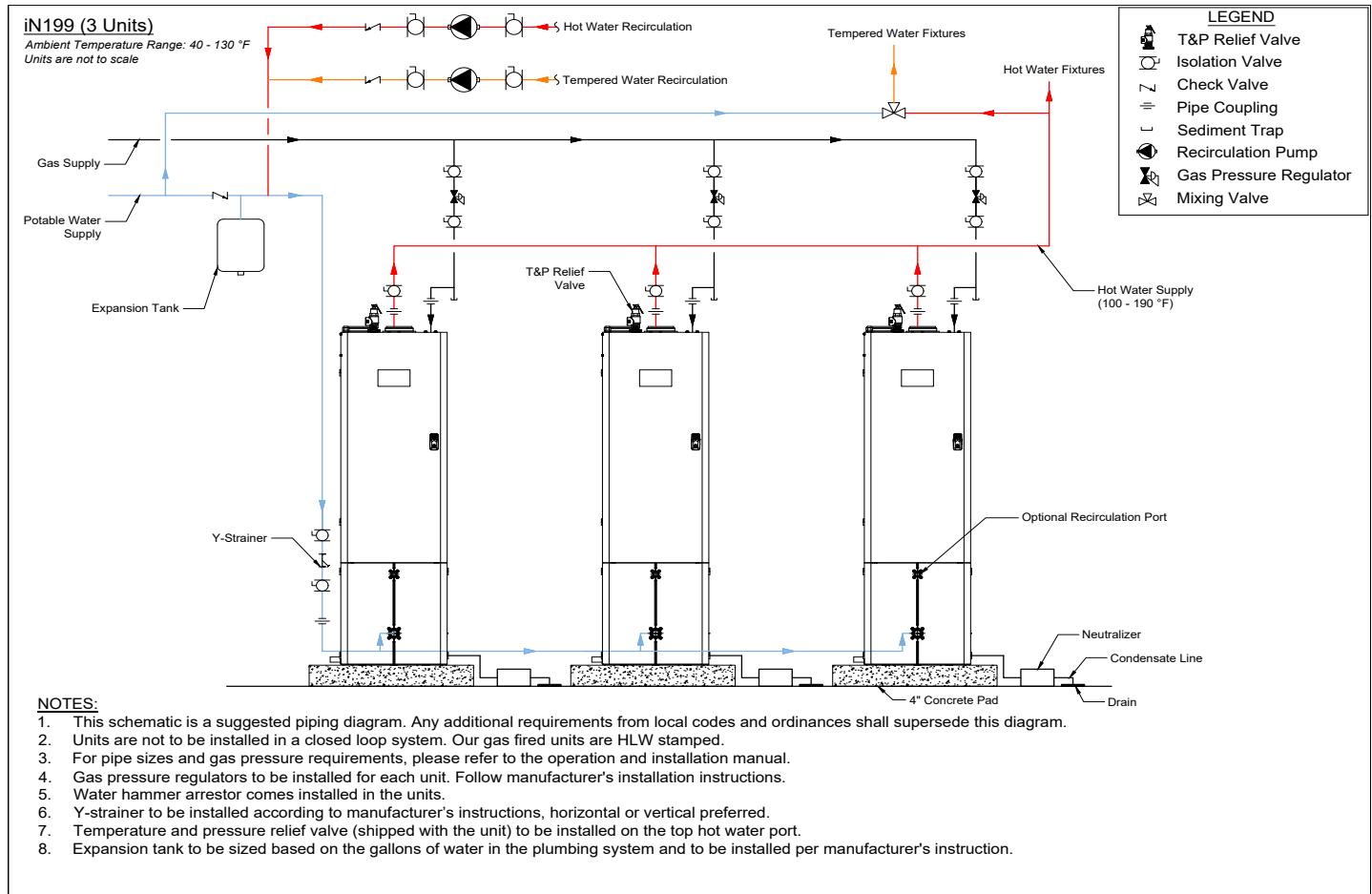


LEGEND	
	T&P Relief Valve
	Isolation Valve
	Check Valve
	Pipe Coupling
	Sediment Trap
	Recirculation Pump
	Gas Pressure Regulator
	Mixing Valve

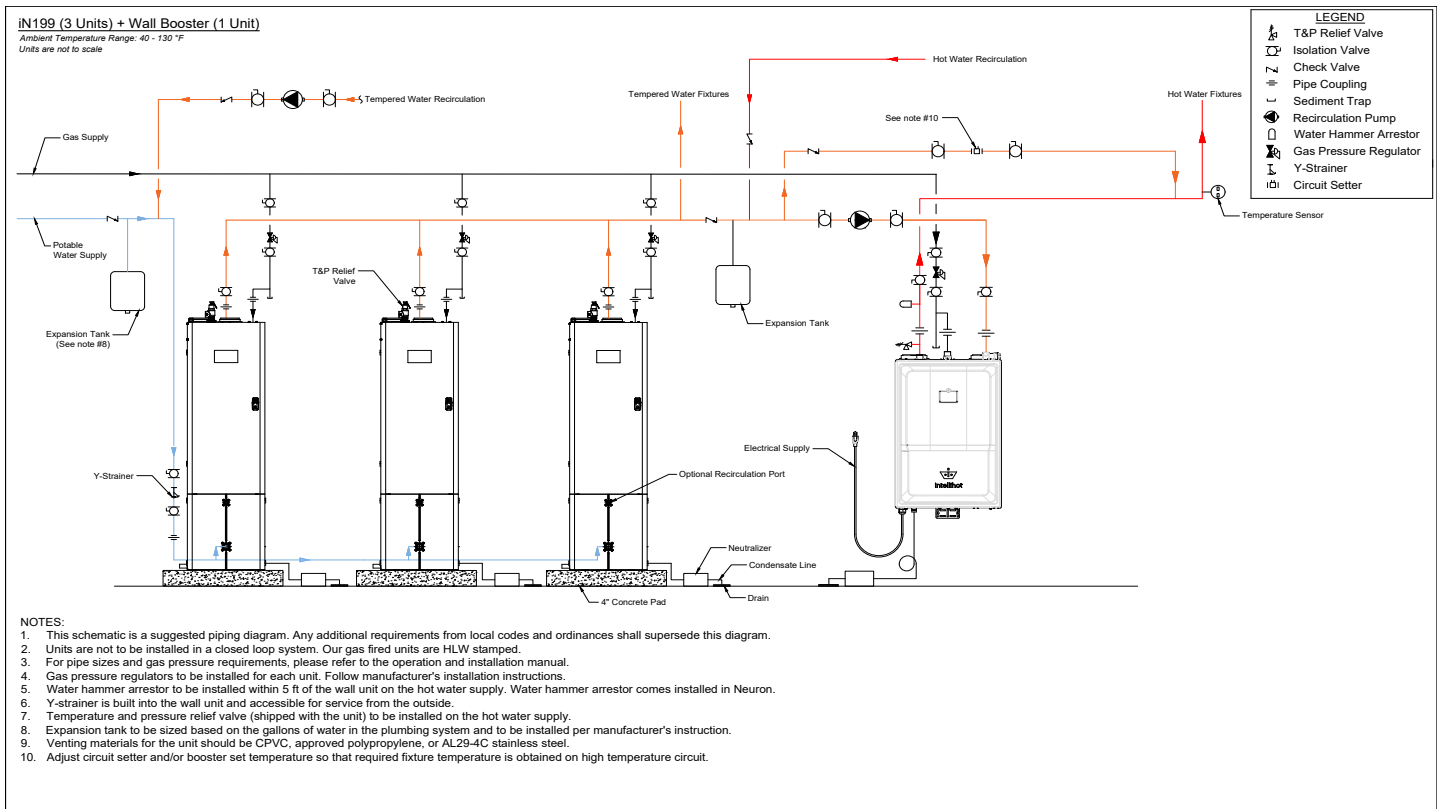
NOTES:

1. This schematic is a suggested piping diagram. Any additional requirements from local codes and ordinances shall supersede this diagram.
2. Units are not to be installed in a closed loop system. Our gas fired units are HLW stamped.
3. For pipe sizes and gas pressure requirements, please refer to the operation and installation manual.
4. Gas pressure regulators to be installed for each unit. Follow manufacturer's installation instructions.
5. Water hammer arrestor comes installed in the units.
6. Y-strainer to be installed according to manufacturer's instructions, horizontal or vertical preferred.
7. Temperature and pressure relief valve (shipped with the unit) to be installed on the top hot water port.
8. Expansion tank to be sized based on the gallons of water in the plumbing system and to be installed per manufacturer's instruction.

Two iN199s with mixing valve but no storage tank.



Three iN199s with mixing valve but no storage tank.



Multiple unit system with a wallhung.

4. Quick Reference Installation Guide

4.1 Install the Water Heater

When installing the water heater, follow all local building codes and the current edition of the National Fuel Gas Code (ANSI Z223.1/NFPA 54) in the USA, or National Gas and Propane Installation Code (CAN/CGA B149.1) in Canada.

Note: For water heater installations in Massachusetts, refer to section “16. Serviceable Parts” on page 61.

1. Select an installation location. Please refer to section “5. Preparation Before Installation” on page 14.
2. Check the quality of the water to determine if additional treatment is beneficial to the function and efficiency of the water heater. For additional information, refer to section “5. Preparation Before Installation” on page 14.
3. Make all necessary gas connections. For additional information, refer to section “6. Gas Connection” on page 15.
4. Make all necessary venting connections. For additional information, refer to section “7. Air Intake Inlet and Exhaust Gas Outlet Pipe Connections” on page 20.
5. Make all necessary water connections. For additional information, refer to section “8. Water Connections” on page 29.
6. Make all necessary electrical connections. For additional information, refer to “9. Electrical Power” on page 31.

Note: For additional electrical protection, a surge protector is recommended. Damage caused by power surges is not covered by the warranty.

7. If necessary, convert the water heater from the factory preset of using natural gas to using propane. Refer to section “11. Natural Gas to Propane Conversion” on page 35 for the instructions.

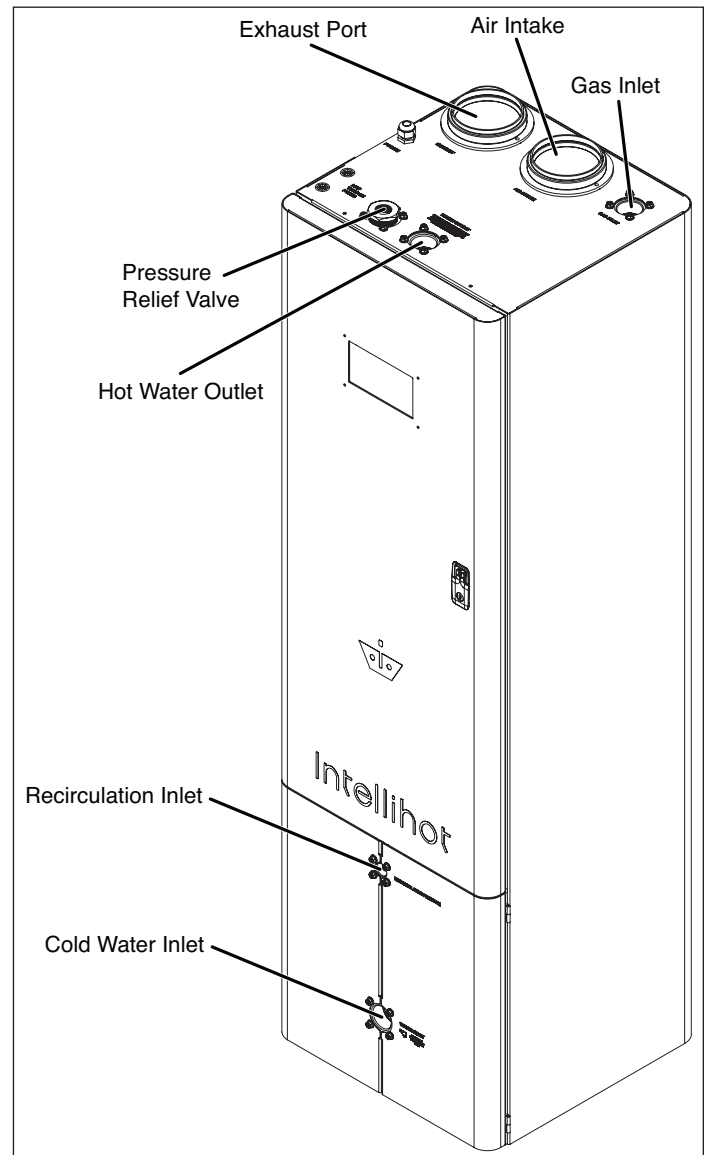
DANGER

Improper propane conversion or not performing the conversion within the 72 hours could cause property damage, serious injury, or even death.

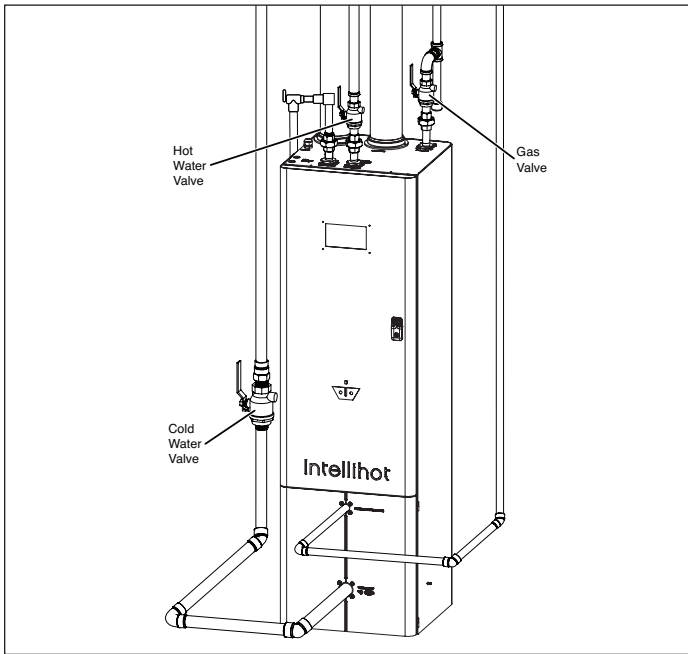
8. As part of the propane conversion process, the CO₂ and CO values must be adjusted. This process is also required when installing the water heater at altitudes over 8,000 feet. This procedure should be completed only by a qualified technician. To check, adjust, or both the CO₂ and CO levels, refer to “10. Adjusting CO₂ Level” on page 32.
9. If connecting multiple units together, refer to “13. Connecting Multiple Units” on page 47.

4.2 Pre-Startup Instructions

1. Recheck the hot and cold water lines, the gas line, condensate drain line, the fresh air inlet, and exhaust vent to make sure they are properly connected.



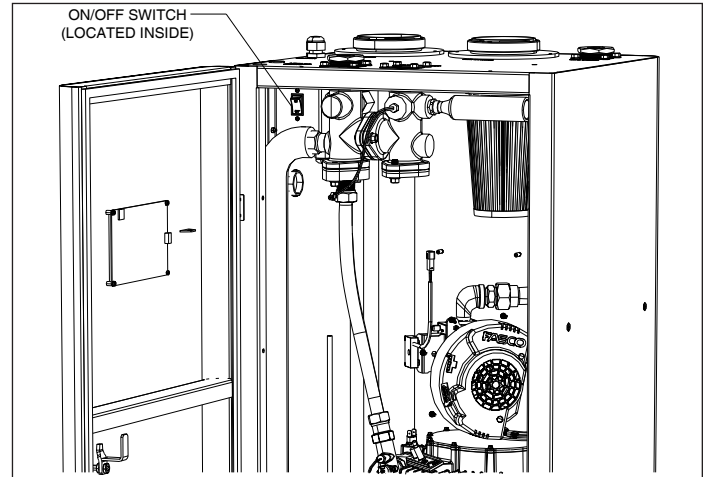
2. Open the gas supply valve, cold water valve, and hot water valve.



Note: Individual regulators not shown for clarity.

3. Before beginning this procedure, be sure power to the unit is off. Open several faucets and fixtures to allow for the maximum water flow rate.
4. Slowly open the outlet isolation water valve.
5. Slowly open the inlet isolation water valve.
6. Allow water to run for 10 minutes to purge all the air from the system
7. Slowly close the outlet isolation valve.
8. Purge air from the pump by opening its bleed screw.
9. Open the T&P valve to eliminate any residual air from the system. Purge for 5 minutes

10. Turn ON the power switch at the electrical junction box and turn ON the ON/OFF switch inside the front cabinet door. The water heater's display panel should turn ON.



11. Slowly reopen the outlet isolation valve to allow maximum flow of water.
12. Ensure the unit is operational and running at high fire with all individual engines operational.
13. Let the unit run a high fire for 15 minutes.
14. Turn off all the open faucets.
15. Follow the instructions in this manual and on the unit's display screen. For additional information, refer to section "12. Operation" on page 37.
16. If multiple units are being installed, follow these instructions for each unit.

5. Preparation Before Installation

5.1 Selecting an Indoor Installation Site

NOTE:

- a. When installing the water heater, follow all local building codes and the current edition of the National Fuel Gas Code (ANSI Z223.1/NFPA 54) in the USA, or National Gas and Propane Installation Code (CAN/CGA B149.1) in Canada when installing this product.
 - b. For water heater installations in Massachusetts, refer to section “16. Serviceable Parts” on page 61.
1. Select an interior location for the installation. Each installation is unique; therefore, take the time to find the best location for the water heater.
 - a. Install the water heater near locations that use hot water, such as bathroom, kitchen, or laundry room faucets.
 - b. Select a location that minimizes the length of the water pipe.
 - c. If the distances are long or if the faucet or appliance requires “instant” hot water, we recommend running a recirculation line back to the water heater from the farthest fixture.
 - d. Insulate the hot water supply and recirculation lines.
 - e. Select a location away from foot traffic and away from areas where dust, debris, chemical agents, or other combustible materials could accumulate.
 - f. Allow sufficient space for service and maintenance access to all gas, water, and drain connections.
 - g. Make sure the location meets all building code requirements.
 2. Minimize the distance that the exhaust gas outlet and air intake inlet must travel to an exterior wall.
 - a. The exhaust vent outlet must not be located next to a walkway, near soffit vents, crawl space vents, or other areas where condensate (water vapor) could cause damage or create a hazard. Refer to section “7.7 Venting Clearance Specifications” on page 25 for additional information.
 - b. The fresh air inlet vent must be separated from the exhaust vent per guidelines in section “7. Air Intake Inlet and Exhaust Gas Outlet Pipe Connections” on page 20.
 - c. Contaminated or dirty air drawn into the intake pipe can damage the water heater. The warranty does not cover damage caused by airborne contaminants.
 3. Locate the unit close to a drain and near gas and water connections.

The water heater produces a significant amount of condensate during normal operation and should be located near a suitable drain where damage from a possible leak is minimal. Installing the water heater in a location without a drain voids the warranty and the manufacturer is not responsible for any resulting water damages that might occur. For additional information, refer to section “8.4 Condensate Drain Line” on page 29.

4. Locate the water heater and all the water pipes in an area where the ambient temperature always remains above freezing.
 - a. When the water heater is connected to an electrical power supply, it automatically prevents the water from freezing inside the unit.
 - b. The unit’s freeze protection system does not prevent the water in the external piping from freezing.

NOTICE

In cold climates, if there is a power failure, the unit’s freeze protection system does not operate and can result in water freezing inside the heat engine. To prevent damage to the water heater, turn OFF the gas supply and inlet water valve. Drain the unit completely. Damage caused by freezing water is not covered by the warranty.

5. Select an appropriate location for the combustion air and exhaust pipes to exit the building, as shown in section “7.7 Venting Clearance Specifications”.
6. Check the water quality.
 - a. Proper maintenance of the water heater is required to ensure that the water meets EPA quality standards. Refer to section “18. Warranty” on page 70 for quality standard requirements and additional information.
 - b. If you suspect that your water is contaminated in any way, discontinue use of the water heater and contact an authorized technician or licensed professional.
 - c. If the incoming water is known to have a high mineral content or “hardness” (see warranty section), treatment is recommended upstream from the water heater.

6. Gas Connection

WARNING

FIRE AND EXPLOSION HAZARD

To avoid serious injury or even death, the gas line installation and the gas line inlet pressure test must be done by a licensed professional.

Always match the water heater with the type of gas supplied to the unit (natural gas or propane). The water heater is factory preset for natural gas.

Make sure the gas line pressures are within normal limits. Pressures outside normal limits can result in poor performance and hazardous operating conditions.

6.1 Quick Reference Installation Instructions

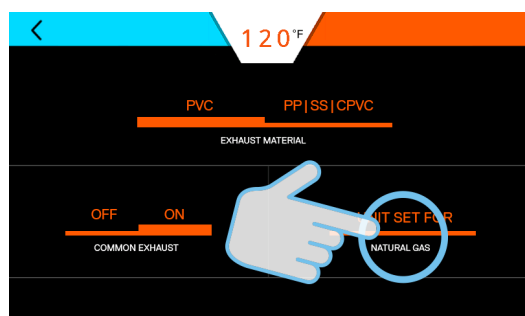
1. Determine fuel source; natural gas or propane as shown in “6.2 Fuel Source” on page 15.
2. Measure gas pressure as shown in “6.3 Gas Pressure Requirements” on page 15.
3. Install a gas pressure regulator and vent line if gas pressure is above maximum recommendations as shown in “6.4 Gas Pressure Regulator” on page 15.
4. Measure the length of the supply line as shown in “6.5 Length of Gas Supply Line” on page 16.
5. Select the proper gas piping material as shown in “6.6 Gas Piping Material” on page 16.
6. Select the proper gas piping diameter as shown in “6.7 Determine Correct Gas Pipe Diameter” on page 16.
7. Install a drip leg on the gas piping as shown in “6.8 Gas Pipe Drip Leg and Shut-off Valve” on page 16.
8. Install a manual shut-off valve as shown in “6.8 Gas Pipe Drip Leg and Shut-off Valve” on page 16.
9. Test all gas line connections for leaks.

NOTICE

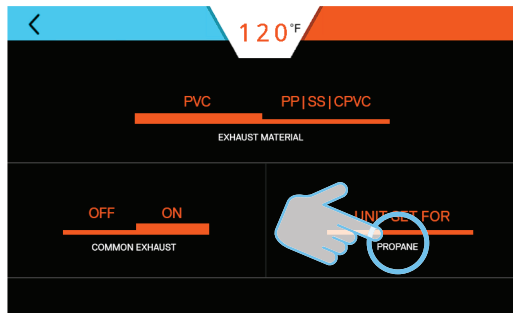
Do not fire (operate) the water heater until all connections have been completed and the heat exchanger is filled with water.

6.2 Fuel Source

1. Natural gas is the factory preset.



2. To convert the unit to propane, refer to section “11. Natural Gas to Propane Conversion” on page 34.



3. Propane conversion must be done within the 72 hours of the water heater being turned ON for heating the water

DANGER

Improper propane conversion or not performing the conversion within the 72 hours could cause property damage, serious injury, or even death.

6.3 Gas Pressure Requirements

iN series water heaters are designed to operate at gas pressures as low as 2.5” Water Column (WC) (at maximum firing rate). Gas inlet pressures to each unit should not exceed 14” WC under any condition (whether the unit is firing or not firing).

Natural Gas Static Gas Pressure	
Parameters	Specifications
Minimum Static Gas Pressure	2.5” WC (non-corrugated, black iron)
Recommended Gas Pressure	8” WC
Maximum Static Gas Pressure	14” WC

6.4 Gas Pressure Regulator

1. If the gas inlet pressure is higher than recommended, install a gas pressure regulator to lower gas pressure to an acceptable level.
2. The gas pressure regulator must have the same or higher minimum to maximum modulation range as the iN model it is regulating. For example, an iN199 gas pressure regulator should have a modulation range of 30,000 BTU/h to 199,950 BTU/h.
3. When multiple units are connected, use a dedicated gas pressure regulator for each unit.
4. Regulators should be mounted with a minimum of 12” of straight length pipe on either side.
5. To convert the unit to propane, refer to “11. Natural Gas to Propane Conversion” on page 34.

6.4.1 Venting of Gas Supply Regulators

Make sure the gas supply regulator is properly vented by following all local codes and the gas regulator manufacturer's recommendations.

1. The vent pipe must be at least the same size as the regulator vent.
2. When multiple units are connected, each regulator must have a separate vent line.
3. Vent lines must not be connected together or connected with any other appliance requiring external venting.
4. When selecting the size, the pipe diameter must be increased by one size for every 20 feet of pipe.
 - Each 90° elbow is equivalent to approximately:
4.5 feet for nominal pipe sizes of up to 1-1/2"
10.5 feet for nominal pipe sizes of up to 4".
 - Each 45° elbow is equivalent to approximately:
2 feet for nominal pipe sizes of up to 1-1/2"
5 feet for nominal pipe sizes of up to 4".

6.5 Length of Gas Supply Line

1. Make sure the length supply line is correctly sized.
 - a. Measure the length of the gas supply line from the gas meter to the water heater or other appliances requiring gas. The diameter of the pipe must be in relation to the length.
 - b. The total length of gas piping, as well as fitting pressure drop, must be considered when sizing the gas piping. Total equivalent length should be calculated from the meter or source location to the last heater connected.
 - c. Gas pipe size should be selected on the total equivalent length. The gas volume for cfm (cubic foot per hour) flow is the input divided by the calorific value of the fuel to be supplied.
 - d. Use the "6.10 Gas Pipe Sizing Tables" on page 17 or refer to the gas line manufacturers sizing information to determine the correct diameter for the supply pipe.
 - e. The diameter of the gas lines vary according to the specific installation requirements.

6.6 Gas Piping Material

1. All gas piping and components must comply with NFPA local codes, and utility requirements minimum. Only gas approved fittings, valves, or pipe should be utilized.
2. Standard industry practice for gas piping is Schedule 40 iron pipe and fittings. All high and low gas pressure piping systems must comply with local utility and building codes.
3. Assembled piping should be clean of all scale, debris, metal particles, or foreign material.
4. The piping must be supported from the floor, ceiling, or walls and by the water heater itself.

6.7 Determine Correct Gas Pipe Diameter

Note: The water heater should be the first appliance to be connected to the gas supply line.

1. Determine the gas requirement of the water heater(s) and other appliances requiring gas.

2. Size the pipe diameter according to the COMBINED total maximum BTUH volume for all the appliances as if they were all operating at the same time. Use the "6.10 Gas Pipe Sizing Tables" on page 18.
3. Select the proper header pipe according to the number of units being connected together, as shown in the chart.

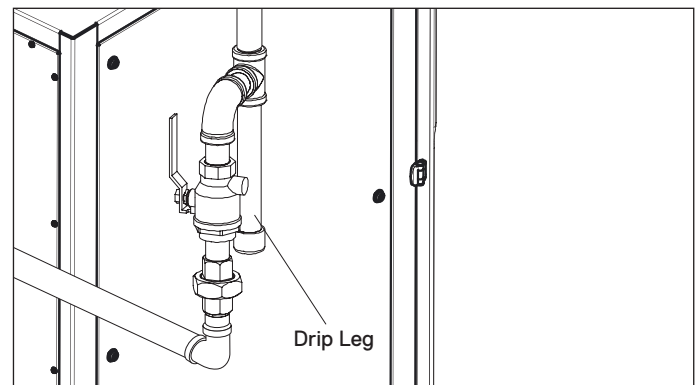
Header Sizing for Multiple iN Units				
Number of Heaters	1	2	3	4
Sch 40 Iron Pipe	1"	1"	1.5"	1.5"

4. The maximum pressure drop from the source to the final water heater must not exceed 0.3" WC.
5. The maximum gas flow rate required is the sum of the maximum inputs of each unit divided by the heat of combustion of the fuel supplied at the location (approximately 1,030 BTU per cubic foot for natural gas or 2,520 BTU per cubic foot for propane).

Note: Consult the fuel supplier or utility to confirm that sufficient volume and normal pressure is provided to the building at the discharge side of the gas meter or supply pipe.

6.8 Gas Pipe Drip Leg and Shut-off Valve

1. Install a gas pipe drip leg on each water heater to prevent dirt, condensation, or debris from entering the gas inlet.



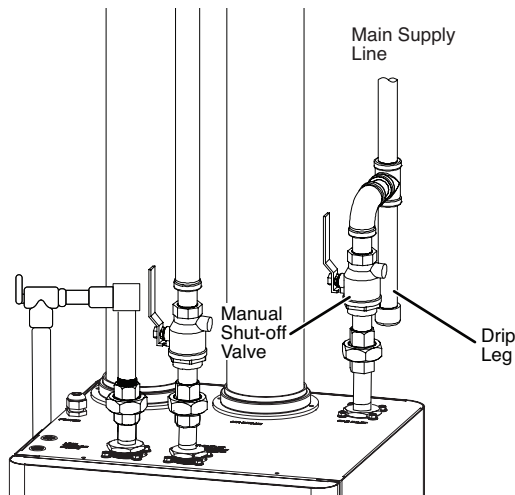
2. Local codes might require multiple units to have a full size drip leg on the main gas supply line and one on each unit.
3. The drip leg should have a removable clean-out cap.
4. The gas pipe must not be supported by the drip leg.
5. Follow local building codes when selecting and installing a shut-off valve.
6. Local codes might require multiple units to have a shut-off valve on the main gas supply line and one on each unit.

DANGER

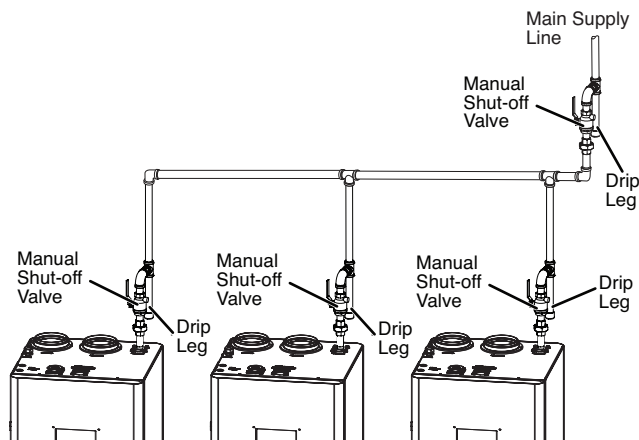
The drip leg is required to protect the gas valve from debris and metal shavings. If the local plumbing code does not allow drip leg, an alternative mechanism such as filter shall be installed to protect the gas valve. The warranty does not cover if the gas valve is stuck open due to missing drip leg (or not including alternative method).

6.9 Connecting Gas Line to Unit

Note: Always clean the inside of the gas line of any dirt or debris before connecting the piping to the unit.

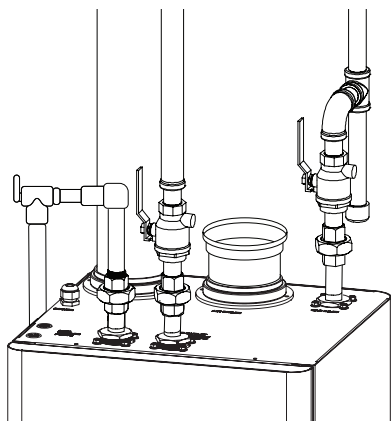


Note: Individual gas regulators not shown for clarity.



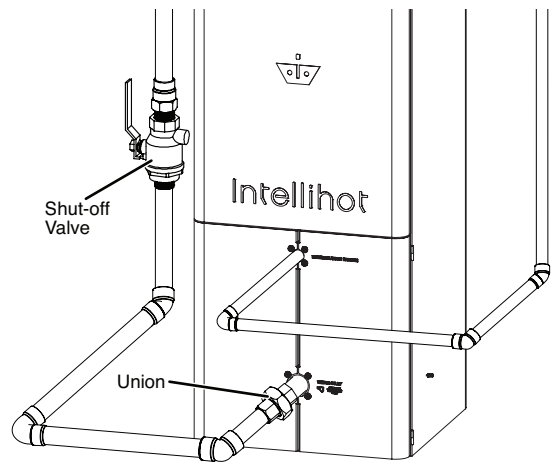
Note: Individual gas regulators not shown for clarity.

1. Install a flanged steel coupling and gasket with a short piece of 3/4" NPT black pipe.



Note: Individual gas regulators not shown for clarity.

2. Install a manual shut-off valve as described in "6.8 Gas Pipe Drip Leg and Shut-off Valve" on page 16.



Note: Wye-Strainer not shown for clarity.

3. Install a drip leg as described in "6.8 Gas Pipe Drip Leg and Shut-off Valve" on page 16.
4. Continue installing pipe to reach the main gas supply connection.
5. Test all gas pipe connections.
 - a. All the gas pipe connections should be tested as prescribed in NFPA 54.
 - b. In multiple unit applications, each unit should be isolated before testing any piping system as pressure might exceed the allowable pressure of 14.0" WC.

NOTICE

Do not fire (operate) the water heater until all connections have been completed and the heat exchanger is filled with water.

6.10 Gas Pipe Sizing Tables

This information is for reference only. Refer to gas pipe manufacturer specifications for actual delivery capacity. Contact the local gas supplier for actual BTU/ft³ rating. This data is copied from the National Fire Protection Association Article 54 (NFPA 54).

Pipe Sizes and BTU/h Capacity (NATURAL GAS). Use this table for static gas pressure LESS THAN 5" WC								
Length including fittings (feet)	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	360,000	678,000	1,390,000	2,090,000	4,020,000	6,400,000	11,300,000	23,100,000
20	247,000	466,000	957,000	1,430,000	2,760,000	4,400,000	7,780,000	15,900,000
30	199,000	374,000	768,000	1,150,000	2,220,000	3,530,000	6,250,000	12,700,000
40	-	320,000	657,000	985,000	1,900,000	3,020,000	5,350,000	10,900,000
50	-	284,000	583,000	873,000	1,680,000	2,680,000	4,740,000	9,660,000
60	-	257,000	528,000	791,000	1,520,000	2,430,000	4,290,000	8,760,000
70	-	237,000	486,000	728,000	1,400,000	2,230,000	3,950,000	8,050,000
80	-	220,000	452,000	677,000	1,300,000	2,080,000	3,670,000	7,490,000
90	-	207,000	424,000	635,000	1,220,000	1,950,000	3,450,000	7,030,000
100	-	-	400,000	600,000	1,160,000	1,840,000	3,260,000	6,640,000
125	-	-	355,000	532,000	1,020,000	1,630,000	2,890,000	5,890,000
150	-	-	322,000	482,000	928,000	1,480,000	2,610,000	5,330,000
175	-	-	296,000	443,000	854,000	1,360,000	2,410,000	4,910,000
200	-	-	275,000	412,000	794,000	1,270,000	2,240,000	4,560,000
Note: BTU/h capacities are based on specific gravity of 0.6, pressure drop of 0.5" WC.								


Pipe Sizes and BTU/h Capacity (NATURAL GAS). Use this table for static gas pressure GREATER THAN 5" WC									
Length including fittings (feet)	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	404,000	949,000	1,787,000	3,669,000	5,497,000	10,588,000	16,875,000	29,832,000	43,678,000
20	286,000	652,000	1,228,000	2,522,000	3,778,000	7,277,000	11,598,000	20,503,000	30,020,000
30	233,000	524,000	986,000	2,025,000	3,034,000	5,844,000	9,314,000	16,465,000	24,107,000
40	202,000	448,000	844,000	1,733,000	2,597,000	5,001,000	7,971,000	14,092,000	20,632,000
50	-	397,000	748,000	1,536,000	2,302,000	4,433,000	7,065,000	12,489,000	18,286,000
60	-	360,000	678,000	1,392,000	2,085,000	4,016,000	6,401,000	11,316,000	16,569,000
70	-	331,000	624,000	1,280,000	1,919,000	3,695,000	5,889,000	10,411,000	15,243,000
80	-	308,000	580,000	1,191,000	1,785,000	3,437,000	5,479,000	9,685,000	14,181,000
90	-	289,000	544,000	1,118,000	1,675,000	3,225,000	5,140,000	9,087,000	13,305,000
100	-	273,000	514,000	1,056,000	1,582,000	3,046,000	4,856,000	8,584,000	12,568,000
125	-	242,000	456,000	936,000	1,402,000	2,700,000	4,303,000	7,608,000	11,139,000
150	-	219,000	413,000	848,000	1,270,000	2,446,000	3,899,000	6,893,000	10,093,000
175	-	202,000	380,000	780,000	1,169,000	2,251,000	3,587,000	6,342,000	9,285,000
200	-	-	353,000	726,000	1,087,000	2,094,000	3,337,000	5,900,000	8,638,000
Note: For 1/2" line, BTU/h capacities are based on specific gravity of 0.6, pressure drop of 4.6" WC and 5.0" WC. For all other line sizes, capacities are based on specific gravity of 0.6, pressure drop of 3.0" WC.									


Pipe sizes and BTU/h capacity (PROPANE). Use this table for static gas pressure GREATER THAN 5" WC.									
Length including fittings (feet)	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	409,000	608,000	1,150,000	2,350,000	3,520,000	6,790,000	10,800,000	19,100,000	39,000,000
20	289,000	418,000	787,000	1,620,000	2,420,000	4,660,000	7,430,000	13,100,000	26,800,000
30	236,000	336,000	632,000	1,300,000	1,940,000	3,750,000	5,970,000	10,600,000	21,500,000
40	204,000	287,000	541,000	1,110,000	1,660,000	3,210,000	5,110,000	9,030,000	18,400,000
50	-	255,000	480,000	985,000	1,480,000	2,840,000	4,530,000	8,000,000	16,300,000
60	-	231,000	434,000	892,000	1,340,000	2,570,000	4,100,000	7,250,000	14,800,000
80	-	212,000	400,000	821,000	1,230,000	2,370,000	3,770,000	6,670,000	13,600,000
100	-	-	372,000	763,000	1,140,000	2,200,000	3,510,000	6,210,000	12,700,000
125	-	-	349,000	716,000	1,070,000	2,070,000	3,290,000	5,820,000	11,900,000
150	-	-	330,000	677,000	1,010,000	1,950,000	3,110,000	5,500,000	11,200,000
175	-	-	292,000	600,000	899,000	1,730,000	2,760,000	4,880,000	9,950,000
200	-	-	265,000	543,000	814,000	1,570,000	2,500,000	4,420,000	9,010,000
Note: The line BTU/h capacities are based on specific gravity of 1.5, pressure drop of 0.5" WC.									

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

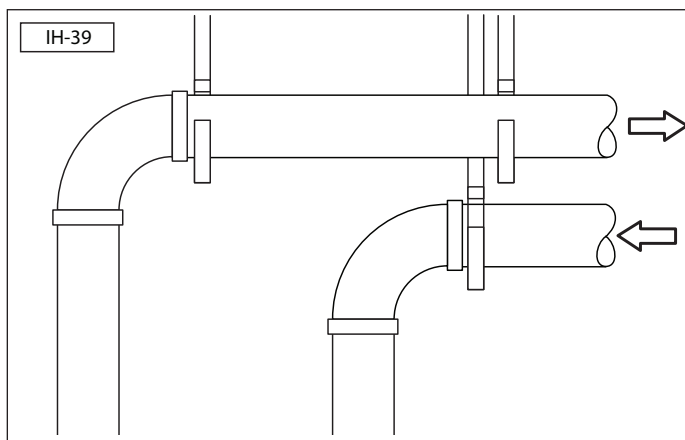
When the unit is set for CPVC (polypropylene pipe), flue temperatures can reach 190°F (88°C). PVC pipe melts at temperatures above 149°F (65°C) and could therefore result in a fire. Make sure the setting and the type of material being used for the flue are compatible.

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.

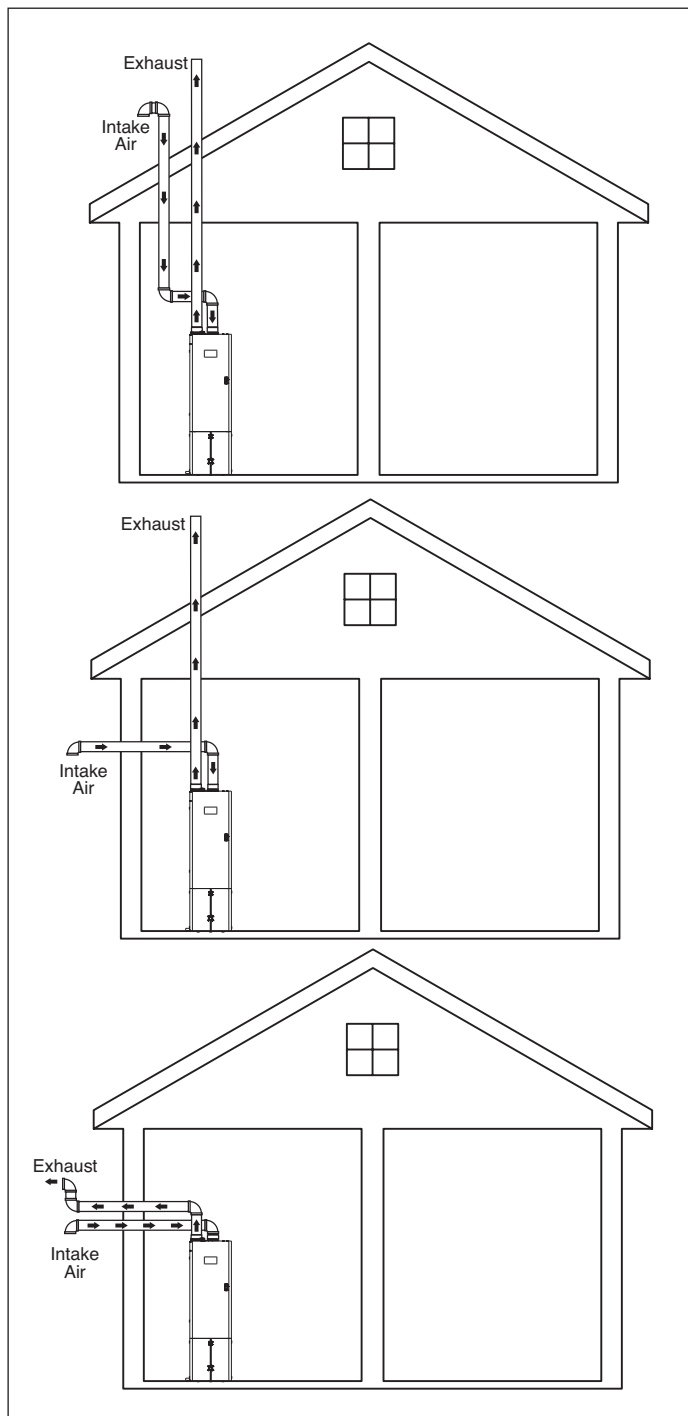
6. If multiple units are installed, make sure the diameter of the connecting exhaust gas outlet pipe is properly sized for the number of units being installed.

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.

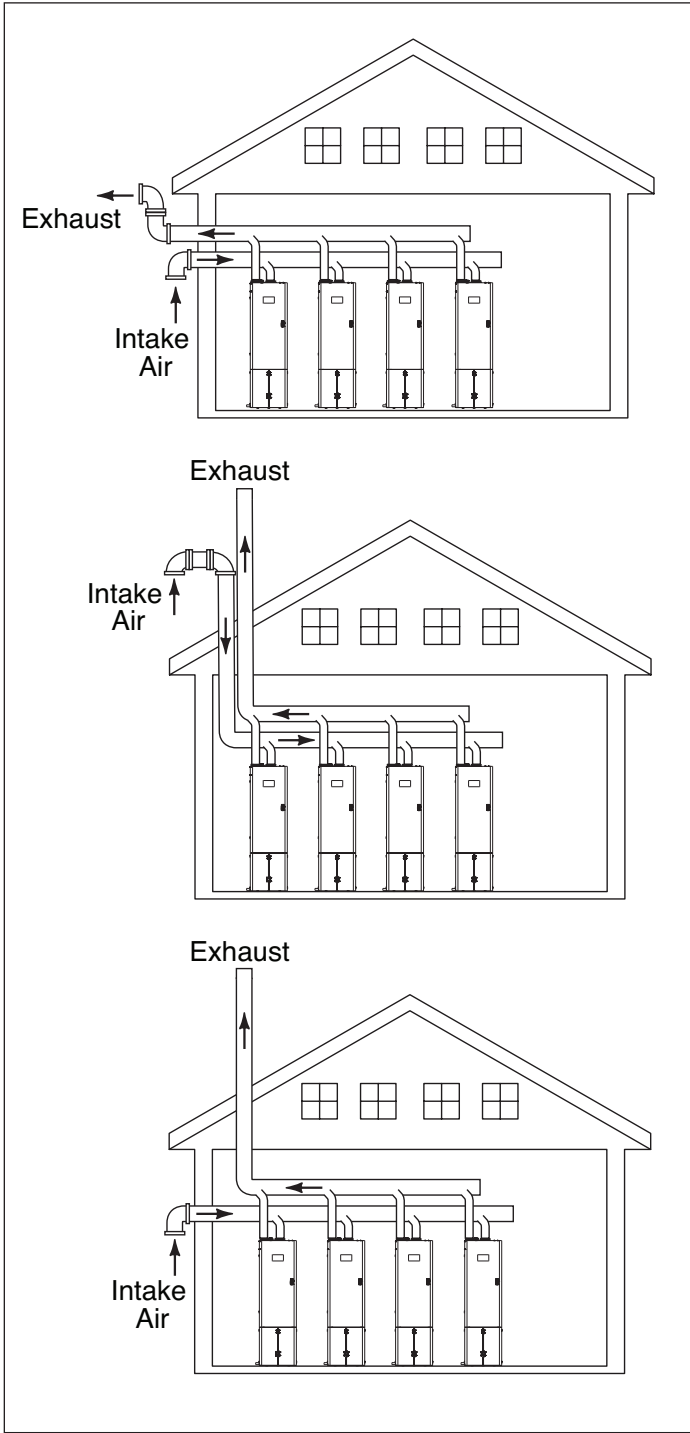


7.3.2 Multiple Units Configurations

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.

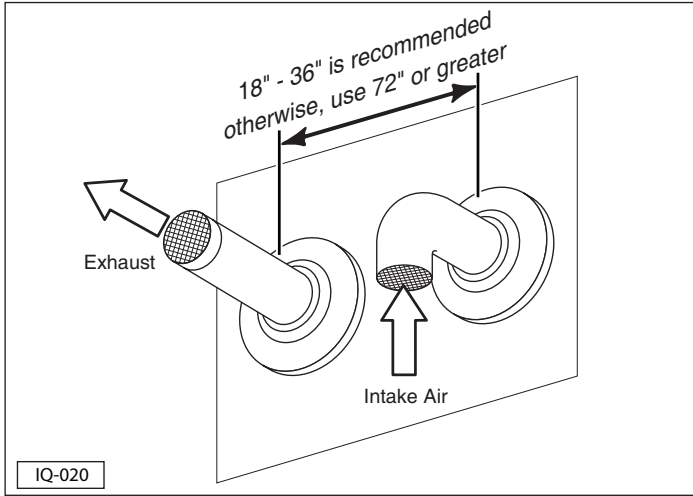
Connecting multiple units together requires proper sizing of the air intake inlet and exhaust gas outlet pipes. Up to four water heaters can be cascaded together. Units which share a common vent must be connected together in a cascading configuration, as described in “13. Connecting Multiple Units” on page 47.

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.

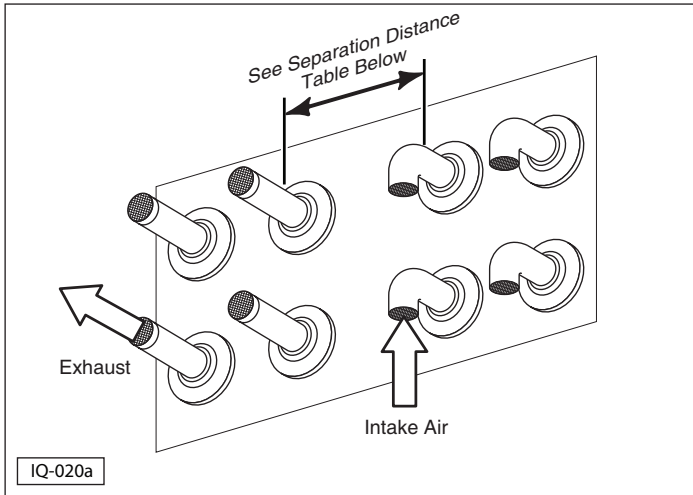


7.3.3 Side Wall Air Intake Inlet and Exhaust Gas Outlet Pipe Termination

- 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.

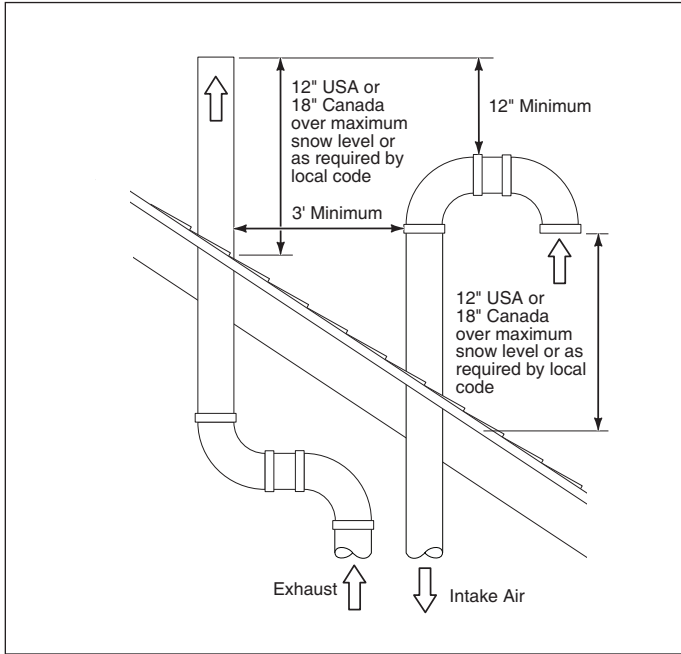
Separation Distance	Status
0 - 17.9"	Not Allowed
18" - 36"	Allowed
36.1" - 71.9"	Not Allowed
72" or greater	Allowed

- 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.

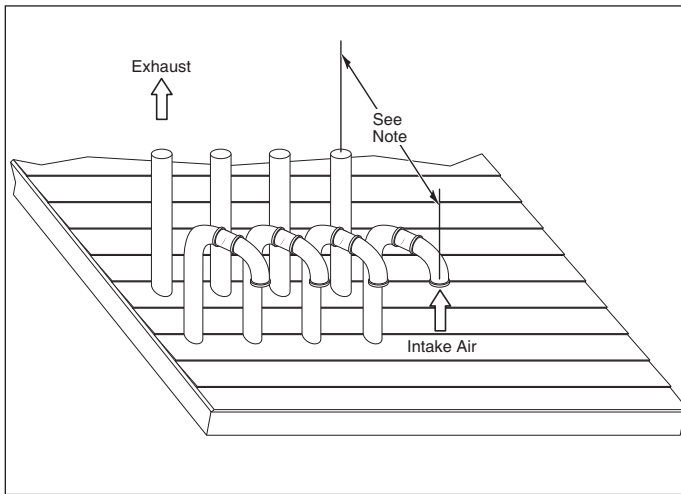
7.3.4 Roof Air Intake Inlet and Exhaust Gas Outlet Pipe Termination

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.



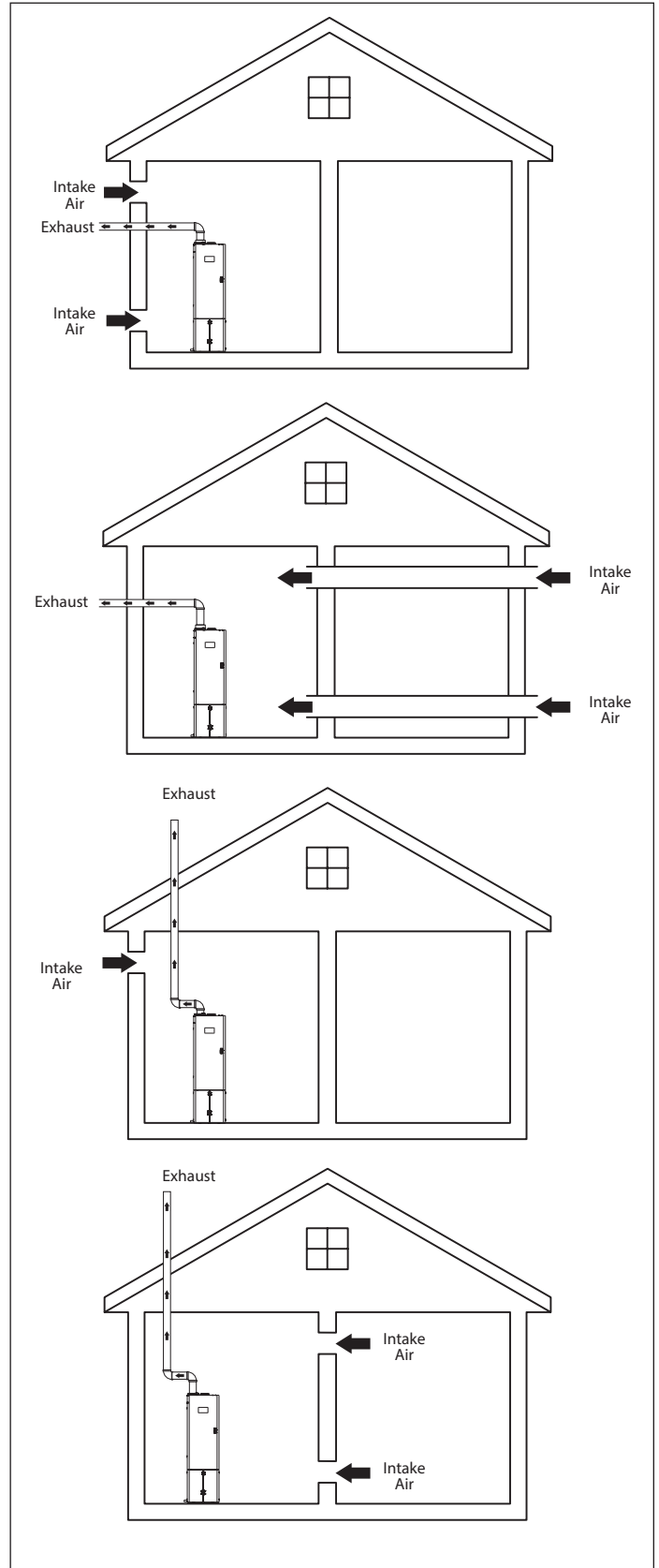
Multiple units.

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

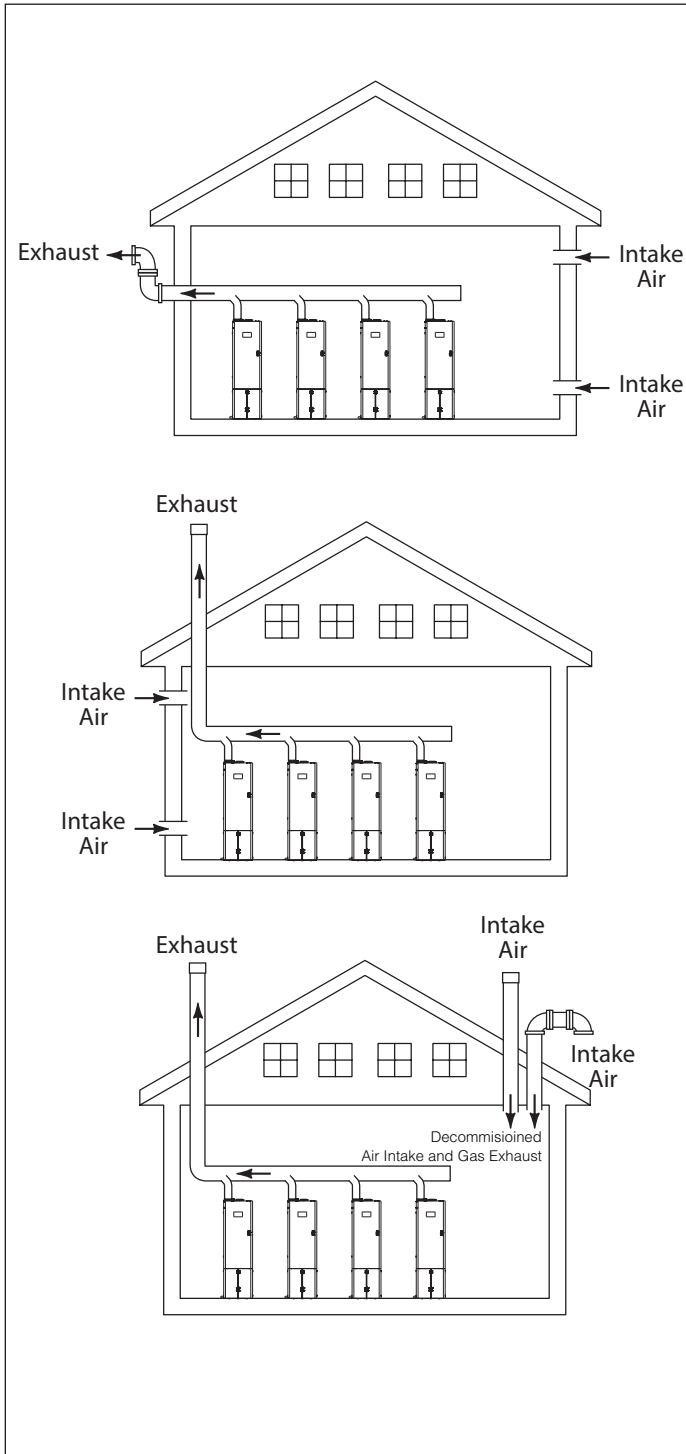
The following illustrations represent some typical venting configurations and are included to assist in designing the vent system. Possible configurations are not limited to these designs.



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 47



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

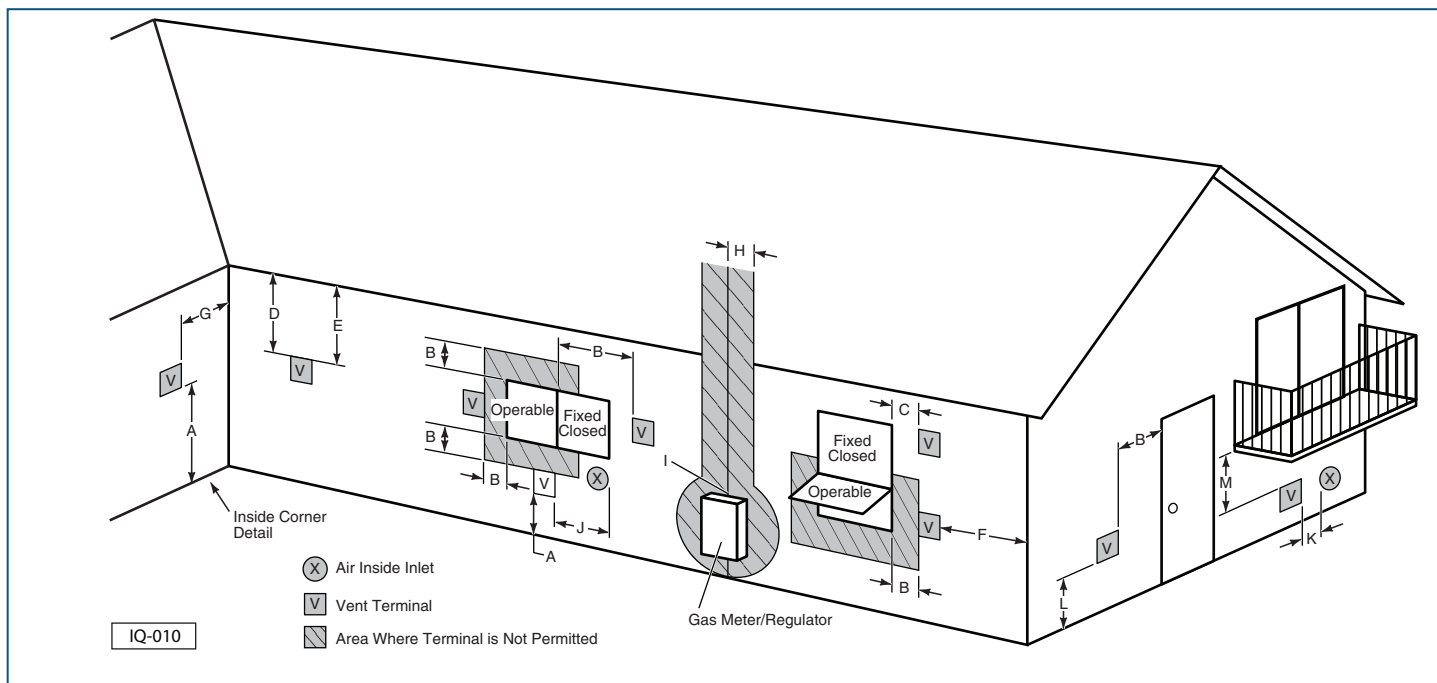
A vent system's length must not exceed the maximum length outlined in the chart below.

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.

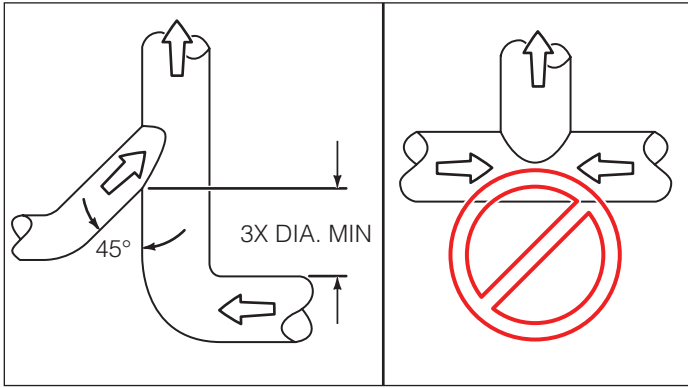
Refer to the tables below for a list of approved materials.

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

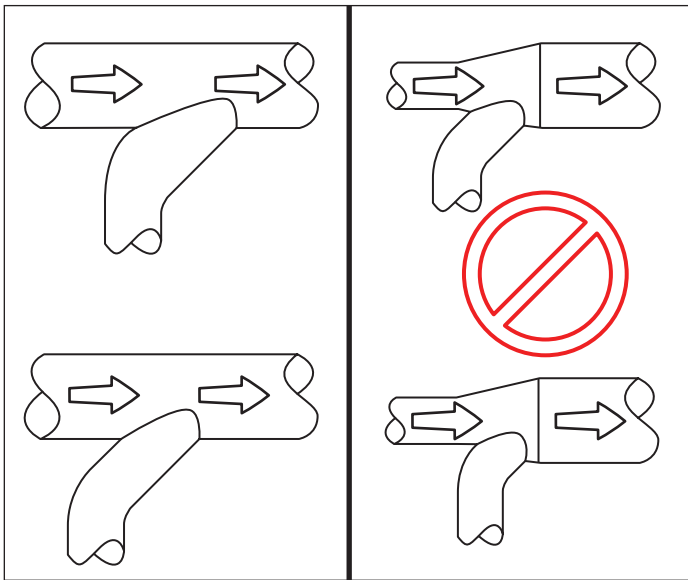
Canadian Vent Pipe Standards	
Material	Description
Vent Pipe	Type BH Special Gas Vent Class IIA (PVC)
	Type BH Special Gas Vent Class IIB (CPVC)
	Type BH Special Gas Vent Class IIC (Polypropylene)

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.

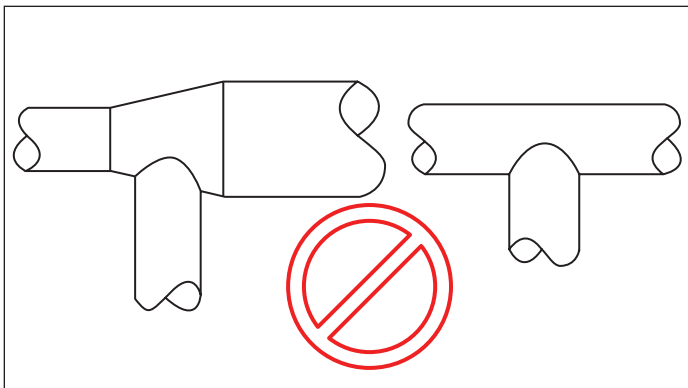
7.10 Recommended Exhaust-Gas Outlet Pipe Transitions



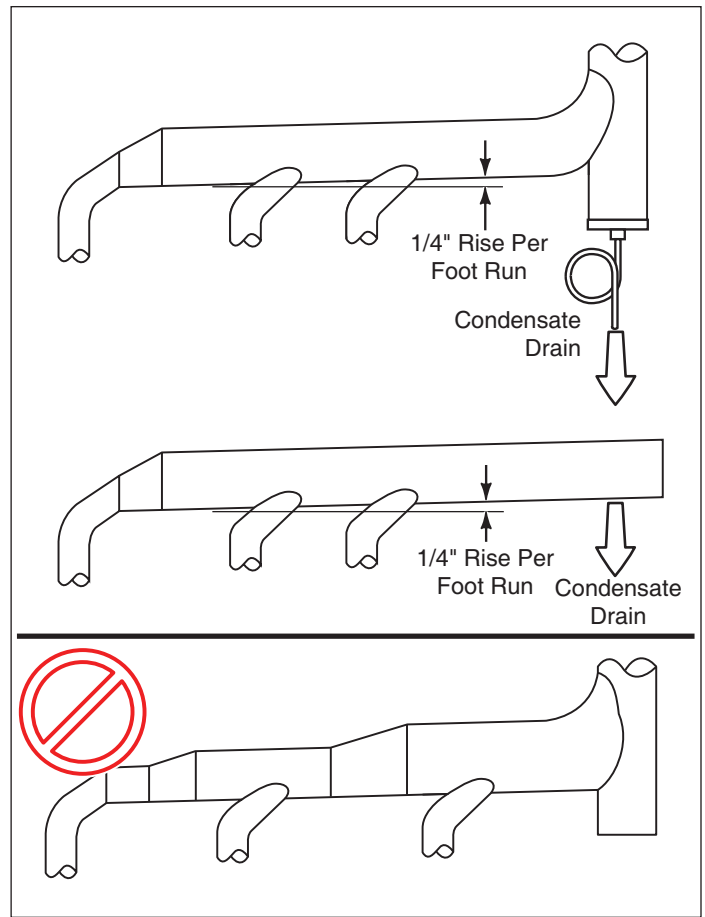
Do not direct exhaust gas from opposite directions. Use a 45 degree transition, as shown.



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.

8. Water Connections

Note: For flow rate changes faster than 10 gpm (gallons per minute) in one second, a water hammer arrester must be installed to prevent damage to the water heater.

8.1 Quick Reference Installation Instructions

1. Install the hot water pipe and the pressure relief valve (furnished with the water heater) as per “8.2 Hot Water Connection” on page 29.

NOTICE

When tightening any fittings to the connections on the water heater, do not overtighten these joints and damage the unit.

2. Install the cold water pipe as per “8.3 Cold Water Connection” on page 30.
3. Install a condensate drain line as per “8.4 Condensate Drain Line” on page 30.
4. After installation is complete, fill and test the water heater for proper flow and inspect for leaks.
5. Run the hot water for a few minutes and then clean the inlet water strainer located on the cold water inlet fitting. This strainer must be cleaned periodically to maintain proper water flow.

8.2 Hot Water Connection

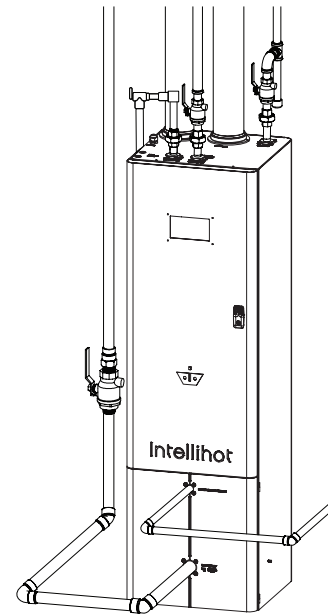
Install and connect the hot water lines. Keep the hot water pipes as short as possible to deliver hot water to the fixtures quickly. If an optional hot water storage tank is required, connect the hot water lines to this tank also.

Since each installation is different, it is up to the installer to route the water lines using the most efficient routing. The drawings shown here are suggestions indicating the items needed for the installation.

CAUTION

To prevent adverse health issues, only materials (pipes, fittings, valves, solder, etc.) that are approved for use in potable water systems should be used.

1. Connect a 1-1/2" NPT coupler to the water heater's hot water connection.
2. Install a 1-1/2" union connection.
3. iN199 supplied with a 150 pressure relief valve. iN199A supplied with a T&P valve. Install the supplied 3/4" 1relief valve, as required by your local code into the port on the outlet pipe of the unit.
4. Following local building codes, install a 1-1/2" manual shut-off valve with 1-1/2" NPT fittings.



Note: Wye-Strainer and gas regulator not shown for clarity.

WARNING

To prevent serious personal injury, do not install any shut-off device between the water heater and the pressure relief valve. This valve is designed to release abnormally high pressure within the water heater in the event of a system problem.

NOTICE

The pressure relief valve must be rated at 150 psi, the maximum btu/h output of the unit, and comply with all local building codes and standards. Do not install any restrictions or other valves before the pressure relief valve.

5. Install and route a discharge pipe from the pressure relief valve to within six inches of the floor and directed away from walkways or other appliances.
 - a. Route the relief valve to within six inches of the floor to prevent injury in the event of a discharge.
 - b. The diameter of the pipe from the relief valve must be equal to the outlet size of the relief valve.
 - c. Do not use reducers in the outlet pipe.
 - d. Do not install any valves, restrictions, elbows, or other blockages in the outlet pipe.
 - e. For multiple unit installations, the outlet pipes must not be connected together. Each pipe must be separately routed to a suitable drain.
6. Connect the unit to the building's hot water pipes. If multiple water heaters are being installed, the diameter of both the main cold water pipes and the main hot water pipes need to be sized by an engineering professional.
7. To conserve energy, insulate all hot water pipes and recirculation pipes.

SAFETY INSTRUCTIONS

Do not insulate the pressure relief valve.

8. With the unit OFF, open a nearby hot water faucet and allow the water to flow through the unit until all the trapped air is exhausted from the water pipes and from the water heater.

9. Leak-test the water piping. Repair any leaks immediately.

8.3 Cold Water Connection

Install and connect the cold water pipes.

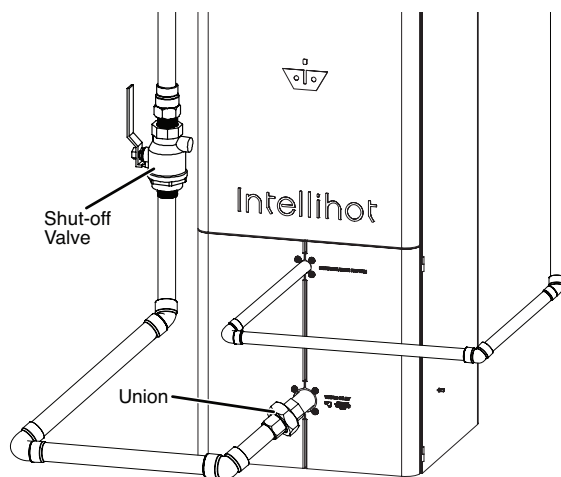
Note: If the incoming water is known to have a high mineral content or “hardness” (see “18. Warranty” on page 70), treatment is recommended upstream from the water heater.

When the water heater is installed in a closed loop recirculation system, and if the cold water supply pipe has a back flow preventer, then an expansion tank should be installed to allow for water expansion as per the diagrams in “3.7 Configuration Options” on page 10.

CAUTION

To prevent adverse health issues, only materials (pipes, fittings, valves, solder, etc.) that are approved for use in potable water systems should be used.

1. Connect a 1-1/2" NPT coupler to the water heater's cold water connection.
2. Install a 1-1/2" union connection.



Note: Wye-Strainer not shown for clarity.

3. Following local building codes, install a 1-1/2" manual shut-off valve with 1-1/2" NPT fittings.
4. Connect the unit to the building's cold water pipes. If multiple water heaters are being installed, the diameter of the main cold water pipe needs to be sized by an engineering professional.

Note: Isolation valve kits can be used if incoming water treatment is anticipated (such as a water softener) due to hardness levels or heavy usage of the unit.

5. With the unit OFF, open a nearby cold water faucet and allow the water to flow through the unit until all the trapped air is exhausted from the water pipes and from the water heater.
6. Leak-test the water pipes. Repair any leaks immediately.

8.4 Condensate Drain Line

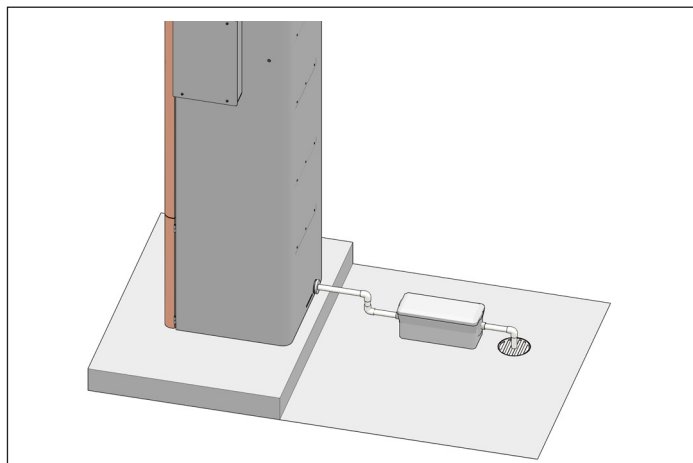
Due to its efficient design, the water heater produces condensate (water) as a normal by-product of heating the water.

This condensate is acidic, with a pH level between 3 and 4. Local building codes might require an in-line neutralizer to be installed (not included) to treat this water.

Model	Max Condensate Flow rate
iN199/iN199A	1.4 GPH
iN251	1.8 GPH

1. Install a 3/4" flexible hose to the hose connection on the water heater.
 - a. If a floor drain is used to remove the discharge, route the condensate drain over or into the drain.

Note: Ensure that the PVC pipe has a slope so that the condensate water drains freely. The line termination should not be immersed in water.



2. Follow applicable local codes and if required, install in-line neutralizer to treat the acidic condensate. Follow all the installation instructions included with the neutralizer.
3. In the picture above a condensate neutralizer setup is shown. The unit is raised up by a 4" concrete base. This allows the condensate water to freely flow into the neutralizer and then to the drain.

SAFETY INSTRUCTIONS

The appliance should be located in an area where leakage within the unit or at its connections will not result in damage to the surrounding area. The manufacturer will not be responsible for any damage resulting from leaking if adequate drainage is not provided.

9. Electrical Power

9.1 Electrical Recommendations

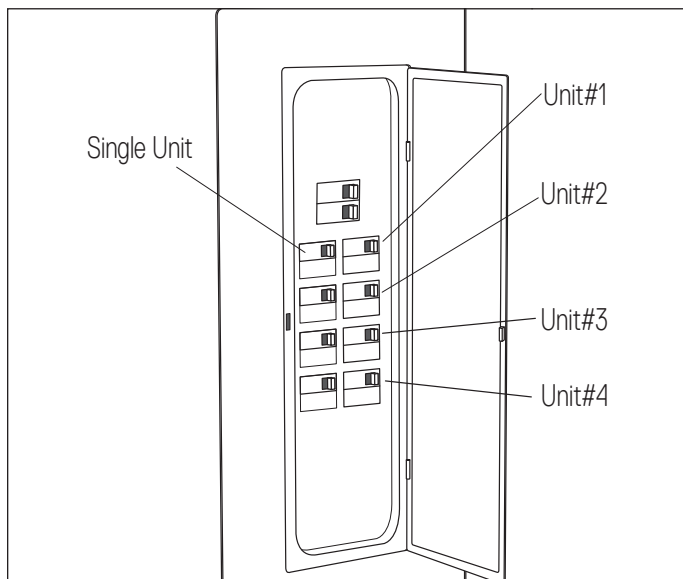
⚠ WARNING

To avoid serious injury or even death, follow all applicable local, state, and national regulations, mandates, and building codes for guidelines to install the electrical power supply.

Electrical code requirements are different in the USA and Canada. Refer to and follow the local building codes, and the latest edition of the National Electrical Code (NFPA 70) in the USA, or the CGA C22.1 Canadian Electrical Code - Part 1.

For a single water heater, the circuit breaker(s) should be at least 15 amps per circuit.

For multiple units, install an adequately sized circuit breaker. Installing a separate circuit breaker for each unit is recommended to isolate units during service or repair.



Note: For an electrical wiring schematic, refer to “15.2 Complete Wiring Diagram” on page 52 for additional information.

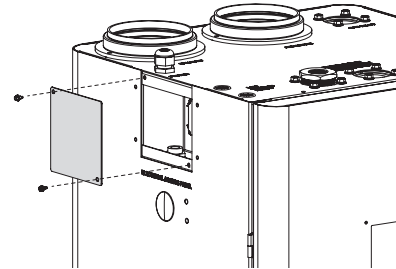
NOTICE

The electrical connections for the water heaters are polarity-sensitive. Before connecting the water heater to the power source, test the polarity of the electrical circuit.

For additional electrical protection, the use of a surge protection device is recommended. Damage(s) caused by power surges is not covered by the warranty.

9.2 Connection Instructions

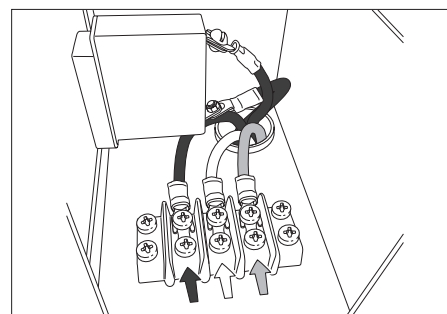
1. On single-unit installations, make sure the electrical outlet being used is wired with at least 12-gauge wire and grounded with an appropriately sized circuit breaker. The electrical power required for the water heater is 120V AC at 60 Hz.
2. Remove the two cover screws and open the cover.



⚠ WARNING

To avoid serious injury or even death from electrical hazards, an additional ON/OFF electrical junction box should be installed near the water heater. This switch allows power to be removed from the water heater prior to service or in the case of an emergency.

3. Route a customer-supplied, appropriately-sized wire with ground from an electrical junction box with an ON/OFF switch through the back panel of the water heater. Route the wire through the cabinet to the junction box.
4. On the opposite side of the block from the factory-installed wiring, connect the white wire to the white terminal, the black wire to the black terminal, and the green ground wire to the green terminal (for each circuit).



5. If multiple units are being installed, refer to “13. Connecting Multiple Units” on page 47 for additional information.

⚠ DANGER

Do not change the internal power wiring connections of the terminals.

10. Adjusting CO₂ Level

10.1 General Information

This procedure is required:

1. Only during installation in a high-altitude location over 2,000 feet, or
2. When converting the unit from natural gas to propane.

This procedure should be completed only by a qualified technician.

DANGER

A concentration of carbon monoxide (CO) as small as 0.04% (400 parts per million) in the air can be fatal. When making High Fire and/or Low Fire adjustments, CO levels must be monitored using a flue gas analyzer and must not exceed 400 ppm of CO at any time during the operation.

Adjusting the “Low Fire screw” or the “High Fire screw” even in small increments can result in a significant increase in CO concentration. To avoid serious injury or death, **DO NOT** adjust the gas valve without monitoring the exhaust gases with a functional and calibrated flue gas analyzer.

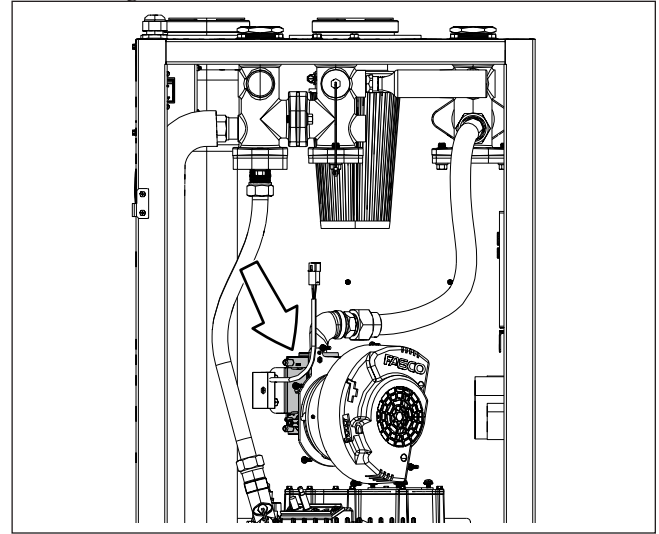
CO ₂ and CO Standards		
Description	CO ₂ Range (%)	Max. CO Level (ppm)
Natural Gas		
High Fire	9.1% to 9.3%	< 200 ppm
Low Fire	9.1% to 9.3%	< 60 ppm
Propane		
High Fire	10.1% to 10.5%	< 200 ppm
Low Fire	10.1% to 10.5%	< 60 ppm

NOTICE

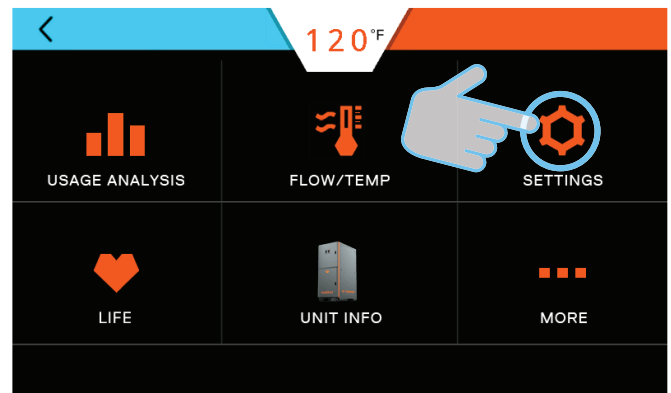
1. The values listed in the table are for nominal conditions. Variables such as gas pressure, heating value of the gas, humidity, and temperature of combustion air can impact CO and CO₂ values. Changes in these variables can result in different CO and CO₂ values on the same water heater.
2. A qualified service technician must use a calibrated flue gas analyzer to adjust the gas valve to achieve the desired CO₂ and CO values.
3. Before any adjustments are made, the service technician must confirm the static gas pressure meets these minimum requirements: Natural Gas - 8" WC; Propane - 11" WC.
4. If units are cascaded and common-vented, these combustions must be done on only one unit at a time. Turn off the valve to the hot water outlet of the other units and power off before doing combustion.

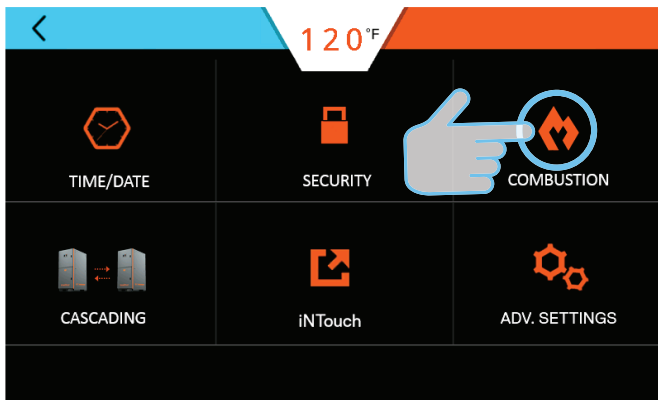
10.2 Adjustment Procedure

1. Open or remove the front doors.
2. Locate the gas valve as shown in illustration.



3. Remove the plug from the test port on the exhaust manifold.
4. Insert a calibrated flue gas analyzer into the test port.
5. Follow the display screens.

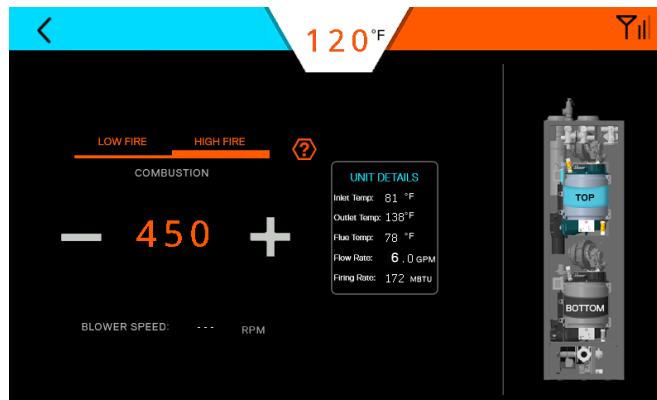




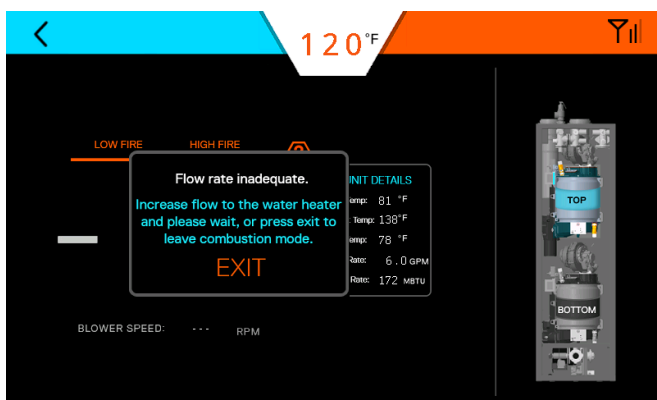
NOTICE

Do NOT change the blower speed settings. This adjustment MUST be completed by factory personnel ONLY. Changing this setting VOIDS the warranty!

6. Create a hot water flow of at least 6.0 GPM as shown on the display screen.



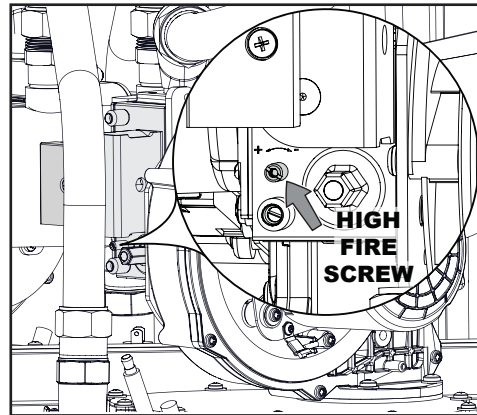
Note: If flow rate is inadequate, a pop-up message notifies you to increase the flow.



7. At a flow rate of 6.0 GPM, the heat engine starts.
8. Press HIGH FIRE on the display screen.
9. Allow three minutes of operation at High Fire.
10. Record "initial output" in Hire Fire Recorded Values table.

11. If the CO₂ values are within appropriate range, proceed to Step 12, otherwise continue.

- a. Use a flat-blade screwdriver to turn the High Fire screw clockwise to decrease and counterclockwise to increase the CO₂ value.
- b. Adjust in ¼ turn increments.
- c. Wait three minutes to stabilize flue gas readings and recheck values.
- d. Adjust until values fall with specified range.

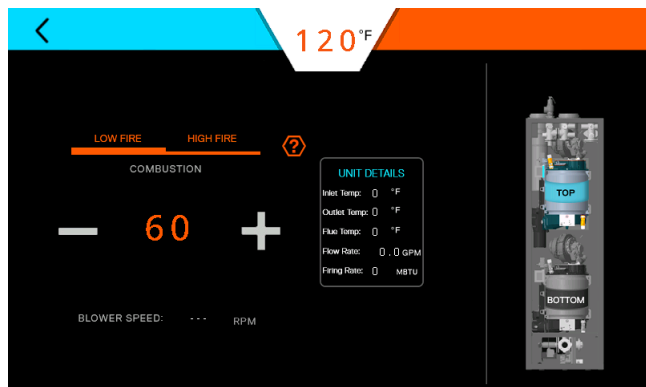


12. After the desired values are achieved, record the new High Fire CO₂ "adjusted values" in the table.

CO ₂ and CO Standards		
Description	CO ₂ Range	Max. CO Level
Natural Gas High Fire	9.1% to 9.3%	< 200 ppm
Propane High Fire	10.1% to 10.5%	< 200 ppm

High Fire Recorded Values		
Date ____ / ____ / ____		
Heat Engine	Initial Output	Adjusted Value
CO ₂ Value %		
Max CO ppm		

13. Press LOW FIRE on the display screen.

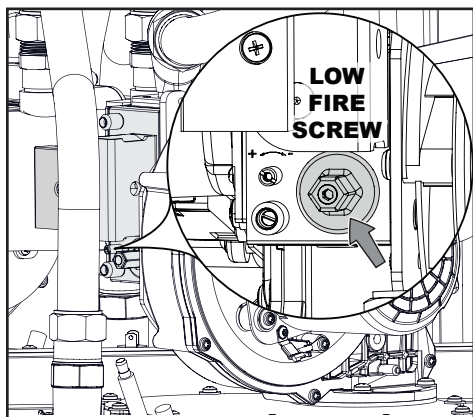


14. Record “initial output” in Low Fire Recorded Values table.

CO ₂ and CO Standards		
Description	CO ₂ Range	Max. CO Level
Natural Gas Low Fire	9.1% to 9.3%	< 60 ppm
Propane Low Fire	10.1% to 10.5%	< 60 ppm

Low Fire Recorded Values		
Date ____ / ____ / ____		
Heat Engine	Initial Output	Adjusted Value
CO ₂ Value %		
Max CO ppm		

15. Adjust the Low Fire screw while the burner operates at low fire using a 2mm hex wrench. Turn clockwise to increase CO₂ and counterclockwise to decrease CO₂.



16. After the desired values are achieved, record the new Low Fire CO₂ “adjusted values” in the table.
17. After the heat engine is properly adjusted, turn off the water flow.
18. Remove the flue gas analyzer probe and plug the test port.
19. Press the back button to return to the main screen.
20. Check for gas leaks using a leak detector.
21. Install side panel covers. If converting to propane, proceed to section “11. Natural Gas to Propane Conversion” on page 35.

11. Natural Gas to Propane Conversion

SAFETY INSTRUCTIONS

A qualified service technician MUST make the required changes to convert the water heater from natural gas to propane.

Propane conversion must be done within the 72 hours of the water heater being turned ON for heating the water.

DANGER

Improper propane conversion or not performing the conversion within the 72 hours could cause property damage, serious injury, or even death.

11.1 General Information

Note: This conversion process also requires the CO2 levels to be adjusted. Refer to "11. Natural Gas to Propane Conversion" on page 3510. Adjusting CO2 Level" on page 31.

Before converting the unit for propane, verify the current gas inlet pressure meets the recommended pressure and record it in the space below.

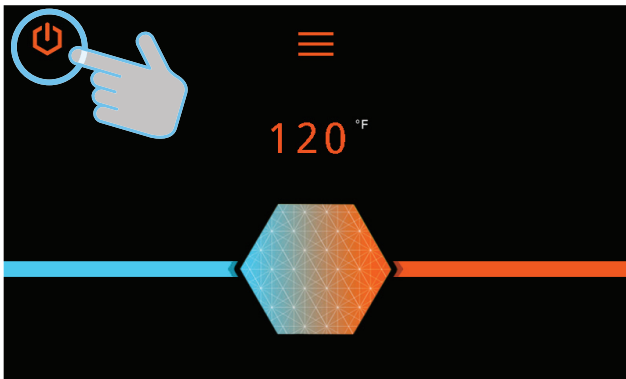
Propane Static Gas Pressure	
Parameters	Specifications
Minimum Static Gas Pressure	8" WC (non-corrugated, black iron)
Recommended Gas Pressure	11" WC
Maximum Static Gas Pressure	14" WC

Current Static Propane Gas Pressure _____WC

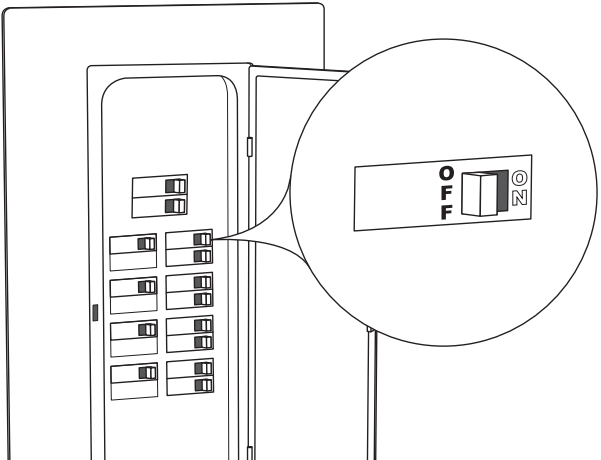
Date _____

11.2 Conversion Procedure

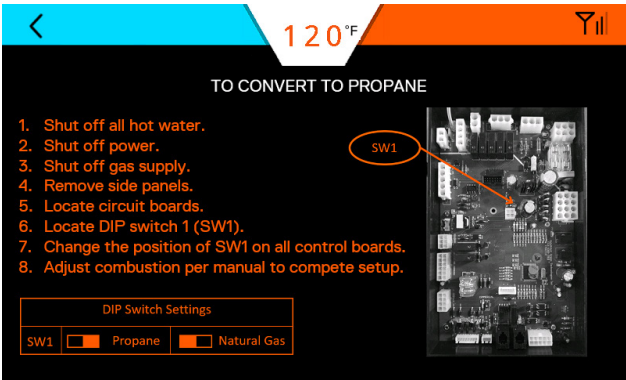
- 1. Follow these steps before repositioning the DIP switches.
 - a. Turn the water heater OFF using the display screen.



- b. Place the circuit breaker for the water heater at the main electrical panel in the OFF position. Verify there is no power to the unit(s).



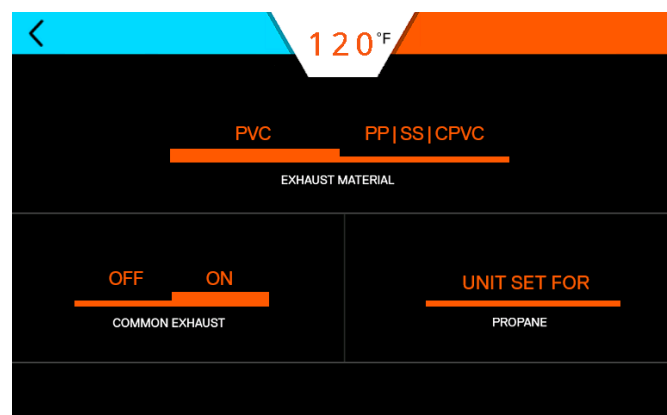
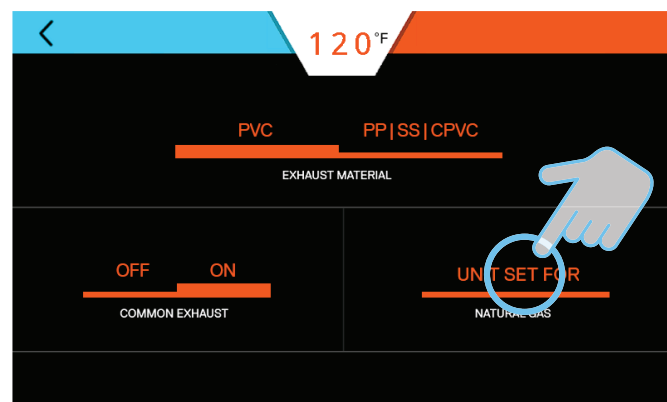
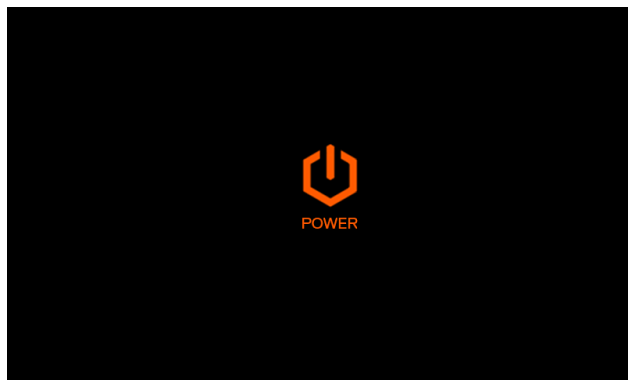
- c. Open the front door and locate the main circuit board.
- d. Locate DIP Switch 1 on the circuit board.



- e. Move DIP switch downward into the Propane position.

DIP Switch Settings (Réglages des commutateurs DIP)			
SW1	ON ↓	Propane	ON ↑ Natural Gas (Gaz naturel)

- f. Reset the circuit breaker to the ON position. Turn the water heater ON using the display screen.



2. Follow the display screens to check if the unit is now set to propane.

