REZNOR®

Revision: CAUA-IOM (10-22) 164771-D

Supersedes: CAUA-IOM (08-22) 164771-C

INDOOR UPFLOW HEATER INSTALLATION, OPERATION, AND MAINTENANCE

MODEL CAUA

Shown with model ACU cased cooling coil.

⚠ DANGER ⚠

FIRE OR EXPLOSION HAZARD

- **Failure to follow safety warnings exactly could result in serious injury, death, or property damage.**
- **Improper installation, adjustment, alteration, service, or maintenance can cause serious injury, death, or property damage.**
- **Installation and service must be performed by a qualified installer, service agency, or the gas supplier.**
- **Be sure to read and understand the installation, operation, and service instructions in this manual.**
- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

WHAT TO DO IF YOU SMELL GAS

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

DO NOT DESTROY. PLEASE READ CAREFULLY. KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

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GENERAL INFORMATION

- The instructions in this manual apply to a model CAUA heater.
- Read this booklet and become familiar with the installation requirements of your particular heater. If you do not have knowledge of local requirements, check with the gas company or any other local agencies who might have requirements concerning this installation.
- This unit has been tested for capacity and efficiency so as to provide many years of safe and dependable comfort providing it is properly installed and maintained. With regular maintenance, this unit will operate satisfactorily year after year. Abuse, improper use, and/or improper maintenance can shorten the life of the appliance and create unsafe hazards.
- To achieve optimum performance and minimize equipment failure, it is recommended that periodic maintenance be performed on this unit. The ability to properly perform maintenance on this equipment requires certain tools and mechanical skills.
- Model CAUA heaters are design-certified by the Canadian Standards Association (CSA) to ANSI Z83.8 and CSA 2.6 for industrial/commercial installations in the United States and Canada. Heaters are available for use with either natural gas or propane. The type of fuel, the firing rate, and the electrical characteristics are on the unit rating plate.
- A model CAUA heater requires installation of an inlet air duct or an optional inlet air base and a supply duct or an optional discharge plenum. Installation of an optional mixing box allows for a mixture of return and outside air. If the air entering the blower will ever be below 35°F, the unit must have been ordered with factory-installed makeup air option AD4 which includes required stainless steel components and a condensate drain.
- This heater may be installed as a separated-combustion system (taking combustion air from outside) or as a power-vented system (taking combustion air from the space where the heater is installed). Separated-combustion units are designed to separate the air for combustion and the flue products from the environment of the building in which the unit is installed. Separated-combustion appliances are recommended for use in dust laden and some corrosive fume environments or in buildings with negative pressure (up to 0.15 IN WC). If installed as a separated-combustion system, the heater must be equipped with both combustion air and exhaust piping to the outdoors. All Model CAUA heaters must be vented to the outdoors.
- If ordered with an optional cooling coil, follow the instructions provided with the coil to install the coil and the thermostatic expansion valves. The coil will be operated with R-410A refrigerant. Follow the instructions with the MASA condenser or other matching condenser.

References

Table 1. Related Technical Manuals Available from Factory Distributor

Type	Form	PN*
Replacement parts	P-CAUA	271166
Gas conversion	CAUA-GC	170635
Ignition control replacement	CAUA-IGN CNTRL	178435
Mixing box installation	CAUA-GA1-GA9	170640
Inlet air mounting base installation	CAUA-AVA2	176515
Return air filter cabinet installation	CAUA-CW4-CW16	166162
Cased cooling coil installation	CAUA-COOLING-COIL	166152
Discharge plenum installation	CAUA-CD60,61,62	176514
Burner condensate drain kit installation	CAUA-COND-DRAIN	165012
Ignition system and gas valve replacement parts	P-VALVES	263995

*Also available at **www.reznorhvac.com**.

Important Safety Information

Please read all information in this manual thoroughly and become familiar with the capabilities and use of your appliance before attempting to operate or maintain this unit. Pay attention to all dangers, warnings, cautions, and notes highlighted in this manual. Safety markings should not be ignored and are used frequently throughout to designate a degree or level of seriousness.

DANGER: A danger statement describes a potentially hazardous situation that if not avoided, will result in severe personal injury or death and/or property damage.

WARNING: A warning statement describes a potentially hazardous situation that if not avoided, can result in severe personal injury and/or property damage.

CAUTION: A caution statement describes a potentially hazardous situation that if not avoided, can result in minor or moderate personal injury and/or property damage.

NOTE: A note provides important information that should not be ignored.

⚠ DANGER ⚠

- **Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne silicone substances.**
- **Should overheating occur, or the gas supply fail to shut off, shut off the manual gas valve to the appliance before shutting off the electrical supply.**
- **Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and replace any gas control which has been under water.**

⚠ WARNING ⚠

- **For your safety, read the warning labels on the unit.**
- **If you turn OFF the power supply, turn OFF the gas.**

NOTES:

- **Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction.**
- **Service work on this heater should only be done by a qualified gas service technician. The service information and the troubleshooting guides are intended as an aid to a qualified service technician.**

Installation Codes

- These units must be installed in accordance with local building codes.
- In the absence of local codes, in the United States, the unit must be installed in accordance with the *National Fuel Gas Code* ANSI Z223.1a (latest edition). A Canadian installation must be in accordance with the *Natural Gas and Propane Installation Code* CSA B149.1 (latest edition). This code is available from CSA Information Services, 1-800-463-6727.
- Local authorities having jurisdiction should be consulted before installation is made to verify local codes and installation procedure requirements.
- **Massachusetts requirement:** if being installed in the Commonwealth of Massachusetts, this unit must be installed by a licensed plumber or licensed gas fitter.

Warranty

Refer to the limited warranty information on the warranty card in the owner's envelope. Warranty is void if:

a. Wiring is not in accordance with the diagram furnished with the heater.

b. Unit is installed without proper clearance to combustible materials.

Dimensions

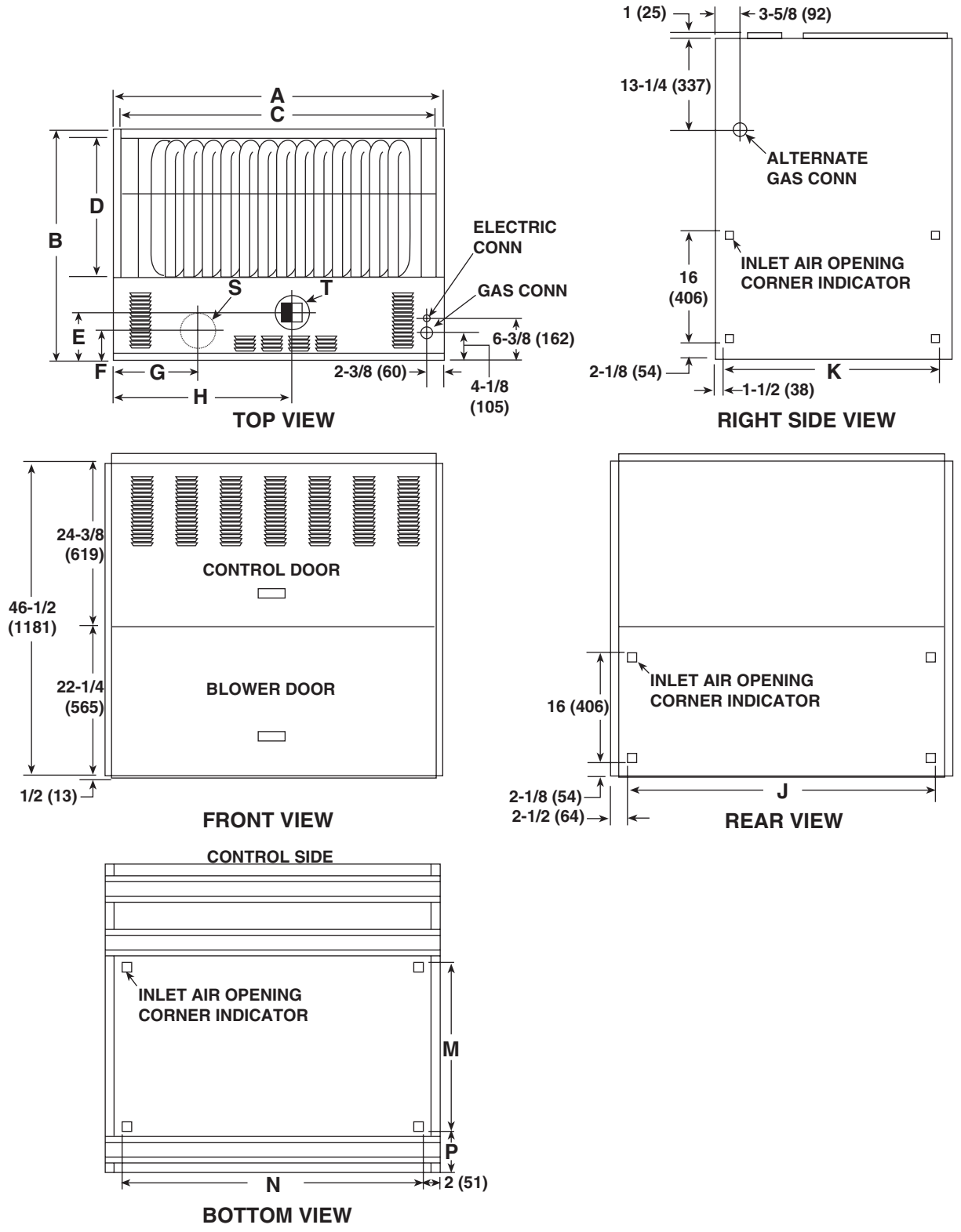


Figure 1. Dimensions (Refer to Table 2)

Table 2. Dimensions															
Unit Size	Dimension (See Figure 1)														
	A	B	C	D	E	F	G	H	J	K	M	N	P	S	T
	Inches (mm)														
150, 200	38 (965)	34-3/4 (883)	36 (914)	21 (533)	7-1/4 (184)	3-3/4 (95)	12-1/2 (318)	24 (610)	33 (838)	31 (787)	19 (483)	34 (864)	4-5/8 (117)	5 (127)	5 (127)
250	50 (1270)	34-3/4 (883)	48 (1219)	21 (533)	7-1/4 (184)	4-3/8 (111)	12-3/4 (324)	27-1/4 (692)	45 (1143)	31 (787)	16 (406)	46 (1168)	4-3/4 (121)	6 (152)	5 (127)
300															6 (152)
350, 400	50 (1270)	50 (1270)	48 (1219)	34 (864)	7 (178)	4-3/8 (111)	14-1/8 (359)	26-3/4 (679)	45 (1143)	44 (1118)	32 (813)	46 (1168)	4-7/8 (124)	6 (152)	6 (152)

Air Opening (See Figure 1)	Inches (mm)
Supply air (discharge with duct flange)	C × D
Inlet air opening, right side or left side (location selected by installer)	16 (406) × K
Inlet air opening, rear (location selected by installer)	16 (406) × J
Bottom	M × N

Weights

Table 3. Weights					
Unit Size					
150	200	250	300	350	400
Net Weight (Pounds (kg))					
288 (131)	300 (136)	380 (172)	394 (179)	445 (202)	460 (209)

Clearances

Clearance to combustibles is defined as the minimum distance—from the heater to a surface or object—that is necessary to ensure that a surface temperature of 90°F (50°C) above the surrounding ambient temperature is not exceeded. The unit must be installed so that the clearances listed in **Table 4** are provided for service and inspection and for proper spacing from combustible construction.

Table 4. Clearances	
Unit Surface	Minimum Clearance (Inches (mm))
Right side, left side, rear, and bottom	0 (0)
Front (service side)	36 (914)
Flue connector	6 (152)
Top	1 (25)

Location

⚠ CAUTION ⚠

- **The unit must be level for proper operation.**
- **Do not locate the unit where it may be exposed to water spray, rain, or dripping water.**

Check the rating plate for the gas specifications including elevation and the electrical characteristics of the heater to ensure that they are compatible with the gas and electric supplies and the elevation of the installation site.

Hazards of Chlorine

NOTE: Remember, chlorine is heavier than air. This fact should be kept in mind when determining the installation location of heaters and building exhaust systems.

The presence of chlorine vapors in the combustion air of heating equipment presents a potential corrosion hazard. Chlorine, found usually in the form of Freon or degreaser vapors, when exposed to flame will precipitate from the compound and form a solution with any condensation present in the heat exchanger or associated parts. The result is hydrochloric acid, which readily attacks all metals, including 300 grade stainless steel. Care should be taken to separate these vapors from the combustion process. This may be done by wise location of the unit with regard to exhausters or prevailing wind directions.

INSTALLATION

NOTE: Before installation, make preparations for necessary supplies, tools, and manpower.

Uncrating/Unpacking

- This unit was test operated and inspected at the factory prior to crating and was in operating condition. If the heater has incurred any damage in shipment, document the damage with the transporting agency and contact an authorized Distributor. If you are an authorized Distributor, follow the FOB freight policy procedures.
- Also, shipped with the heater are the parts needed to install a heat section condensate drain (needed if installing a cooling coil).

Shipped-Separate Parts

Table 5. Shipped-Separate Options

Option	Component*	Description
ACUA, ACUB, ACUC, C	Cased cooling coil	Coil is shipped separately for installation in discharge opening of heater
		Thermostatic expansion valve kit for R410A refrigerant and the size of unit is shipped loose for field-installation
AVA2	Inlet air mounting base (unit sizes 350 and 400)	Heater ordered with inlet base mounts on base and has bottom inlet air opening
CC2, CC6	Concentric adapter and vent terminal	If heater is installed as separated-combustion system, concentric adapter assembly is required
		Concentric adapter and parts are shipped in separate carton
CD60, CD61, CD62	Discharge plenum (unit sizes 350 and 400)	Discharge plenum is shipped separately for installation over discharge opening of heater
		If discharge plenum and cased cooling coil are part of installation, discharge plenum is attached to cooling coil casing at factory
CW4, CW5, CW6, CW7, CW8, CW9, CW10, CW11, CW12, CW13, CW14, CW15, CW16	Return air filter cabinet	Return air filter cabinet is shipped separately for field-installation over inlet air opening of heater
		Inlet air opening location is determined by application
		Filter cabinet can be attached to rear, left side, right side, or bottom of unit
GA1, GA2, GA3, GA4, GA5, GA6, GA7, GA8, GA9	Mixing box	If application includes bringing in outside supply air, mixing box must be attached to unit
		Mixing box is shipped separately for field-installation on rear of unit
PC	Vibration isolators	If vibration isolators are part of installation, four pads are shipped separately and must be field-installed on bottom at each corner of unit

*Refer to the component installation manual listed in **Table 1** for kit components and installation instructions.

- If any of these shipped-separate accessories are part of the installation, check to ensure that the required parts are at the installation site.
- Other shipped-separate options could include a gas shutoff valve, a thermostat, a thermostat guard, and/or a vent cap. Make sure all parts are at the site before beginning installation.

Positioning and Mounting

- Determine the position of the heater with regard to clearances, venting, combustion air, gas supply connection, electrical supply connection, and the inlet air opening.
- **Vibration isolation pads (option PC4):** If the installation includes optional vibration isolation pads, tip the corner of the unit enough to slide a pad underneath. Remove the access panel and secure the pad to the cabinet with the screw provided. Repeat the procedure at all four corners.

Duct Connections

⚠ CAUTION ⚠

To prevent possible motor overloading, ensure that the external duct system static pressure is within the limits shown on the rating plate and that the motor pulley and belt are properly adjusted.

Requirements and Suggestions for Connecting and Installing Ducts

- **Type of ductwork:** The type of duct installation to be used depends in part on the type of construction of the building.
- **Ductwork material:** Rectangular duct should be constructed of galvanized iron—not lighter than No. 26 US gauge —or aluminum—No. 24 B&S gauge.
- **Ductwork structure:** All duct sections 24 inches (610 mm) or wider and over 48 inches (1,219 mm) in length should be cross-broken on top and bottom and should have standing seams or angle-iron braces. Joints should be S and drive strip or locked.
- **Through masonry walls:** No warm air duct should come in contact with masonry walls. Insulate around all air duct through masonry walls with 1-inch (not less than 1/2-inch) of insulation.
- **Through unheated space:** Insulate all exposed warm air ducts passing through an unheated space with 1-inch (not less than 1/2-inch) of insulation.
- **Duct supports:** Suspend all ducts securely from adjacent buildings members. Do not support ducts from unit duct connections.
- **Duct sizing:** Proper sizing of the supply air ductwork is necessary to ensure a satisfactory heating installation. The recognized authority for duct size is the Air Conditioning Contractor's Association, 2800 Shirlington Road, Suite 300, Arlington, VA 22206 (**www.acca.org**). A manual covering duct sizing in detail may be purchased directly from them.
- **Access panels:** Install removable access panels on both the upstream and downstream sides of the furnace. The access panels must be accessible when the furnace is in service and should be a minimum of 6 × 10 inches (152 × 254 mm) in size so smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. Ensure that the access panels are installed in such a manner so as to prevent leakage.

Inlet Air Ductwork

- Inlet air ductwork is required unless equipped with inlet base option AVA2. Filters are recommended when a cooling coil is part of the installation. Inlet air may be 100% return air, a mixture of return and outside air (air entering the blower must be ≥35°F unless equipped with makeup air option AD4), or 100% outside air if equipped with makeup air option AD4.

⚠ CAUTION ⚠

Use tin snips or aviation shears to cut the inlet air opening. Use caution as the cut edges of the metal will be sharp.

- The inlet air opening (refer to **Table 6**) may be in the right side, in the left side, in the rear, or in the bottom of the cabinet and must be cut by the installer. Either cut out the inlet air opening now or when attaching the filter cabinet or mixing box. If the application includes an optional bottom filter cabinet, either lay the heater down and cut the opening now or cut it out from the inside after the heater is placed on the bottom filter cabinet. Attach the ductwork to the heater or to the inlet cabinet.

Table 6. Inlet Air Opening Dimensions

Opening Type	Location	Unit Size		
		150, 200	250, 300	350, 400
		Dimensions (Inches (mm))		
Without optional filter or mixing cabinet (actual cutout opening on heater)	Right and left sides	31 × 16 (787 × 406)	31 × 16 (787 × 406)	44 × 16 (1118 × 406)
	Rear	33 × 16 (838 × 406)	45 × 16 (1143 × 406)	45 × 16 (1143 × 406)
	Bottom	25-1/2 × 32 (648 × 813)	37-1/2 × 32 (953 × 813)	37-1/2 × 46 (953 × 1168)
With optional side or rear filter cabinet (duct opening in top or rear of cabinet)	Attached to heater side	32 × 16 (813 × 406)		45-1/8 × 16 (1146 × 406)
	Attached to heater rear	32 × 16 (813 × 406)	45-1/8 × 16 (1146 × 406)	
With optional bottom filter cabinet (duct opening in bottom of cabinet)	Under heater	25-1/2 × 32 (618 × 813)	37-1/2 × 32 (953 × 813)	37-1/2 × 46 (953 × 1168)
With optional mixing box (duct opening in top, bottom, or rear of cabinet)	Attached to heater rear	22 × 19-1/2 (578 × 495)	36-1/2 × 19-1/2 (927 × 495)	

Duct Connections—Continued

Discharge Air Ductwork—Continued

NOTE: Refer to the inlet air option installation manual listed in Table 1 for kit components and installation instructions.

- **Filter cabinet (option CW, return air only):** All of the filter cabinets have a duct flange for attaching the inlet air duct. For inlet duct dimensions, refer to **Table 6**.
- **Outside air and return air mixing box (option GA):** All mixing box inlet air openings have duct flanges for attachment of ductwork. Ductwork must be attached to the outside air opening. Removable door panels provide for filter access from either end of the cabinet. If the mixing box was ordered with optional filters, it is shipped with the filters installed. For inlet duct dimensions, refer to **Table 6**.

NOTE: If ordered with an optional inlet base, the heater is shipped with a factory-provided opening in the bottom.

- **Inlet air mounting base (option AVA2):** The optional inlet air mounting base is designed to support a model CAUA 350 or 400 heater while providing an inlet for return air. The mounting base is designed to be used with an optional discharge plenum to create packaged stand-alone heating or heating/cooling upflow system which can be used in an air turnover application. However, if the installation requires it, the mounting base may also be used with discharge ductwork.

Discharge Air Ductwork

NOTE: If the unit is being installed as a makeup air unit with two-stage control (option AG3), refer to the Ductstat (Two-Stage, Makeup Air, Option AG3) section for instructions on installing the duct sensor.

- The discharge duct connects to the top of the heater or to the outlet of the optional cooling coil cabinet. Connect the ductwork plenum to the duct flange as shown in **Figure 2**. The duct connection on the top of the heater has a 90° flange. The duct may either have no flange or a 90° flange. Position ductwork around the outside of the heater flange. If the ductwork has a flange, drill holes vertically through duct flange into the top of the heater and secure using sheet metal screws. If the ductwork does not have a flange, drill holes horizontally through the ductwork and the heater flange and secure using sheet metal screws.
- **Removable access panel in ductwork (see Figure 2):** Minimum size is 6 inches × 10 inches (152 mm × 254 mm). Panel must be sealed.

NOTE: Refer to the discharge air option installation manual listed in Table 1 for kit components and installation instructions.

- **Discharge plenum (option CD):** The optional discharge plenum is designed to be used with a screened mounting base to create a packaged stand-alone upflow system that circulates building air. However, the discharge plenum may also be used in place of ductwork in applications that do not have an optional mounting base. The discharge plenum is available in three types. Options CD60 and CD61 are for a heater without a cooling coil. Option CD60 is designed for an open area. Option CD61 includes field-installed blockoff plates to block off one or two sides. Option CD62 can only be ordered with a cooling coil and includes blockoff plates to provide higher velocity required for cooling.

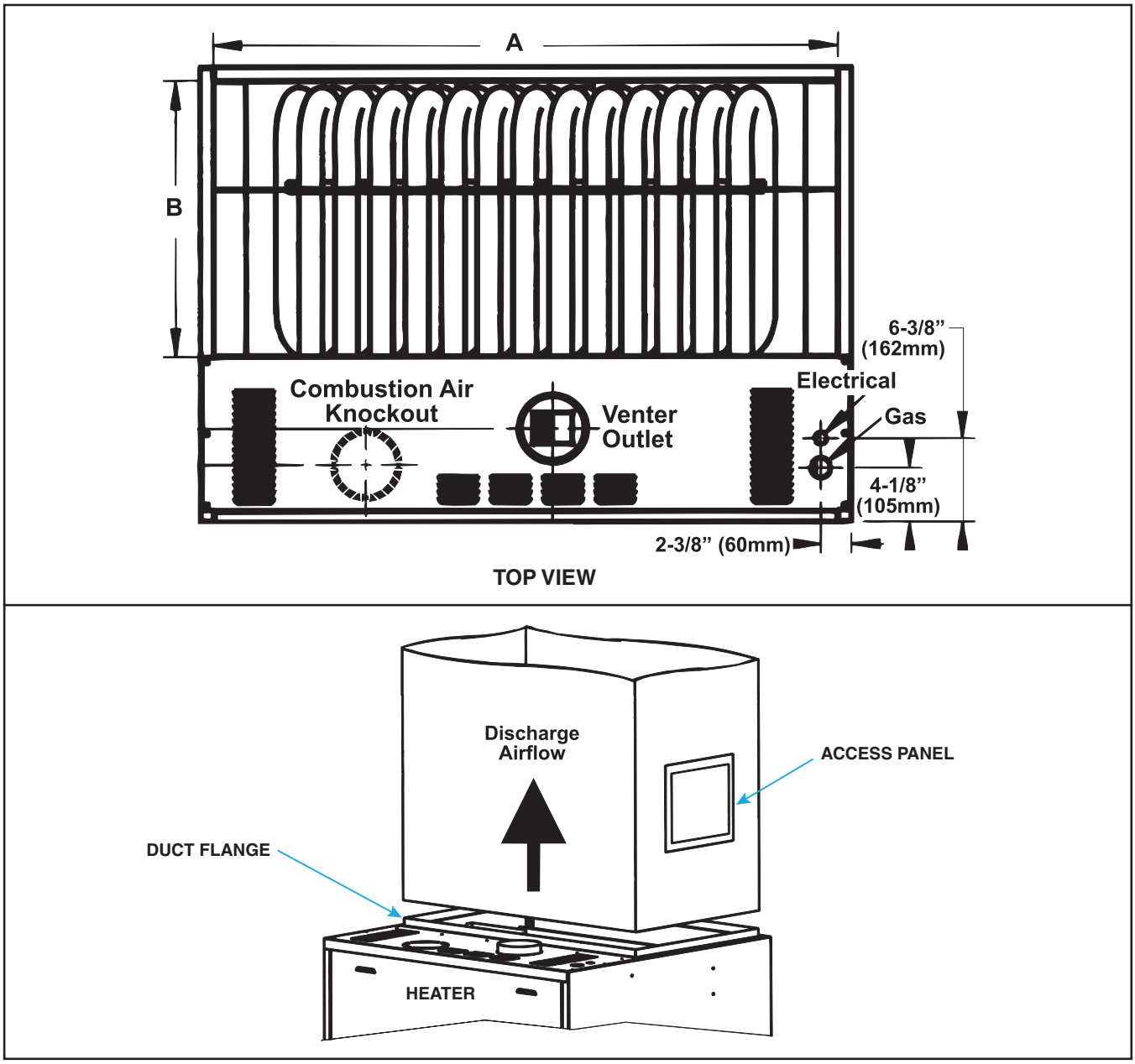


Figure 2. Discharge Duct Connection (Refer to Table 7)

Table 7. Discharge Duct Dimensions

Dimension (See Figure 2)	Unit Size		
	150, 200	250, 300	350, 400
	Dimensions (Inches (mm))		
A	36 (914)	48 (1219)	48 (1219)
B	21 (533)	21 (533)	34 (864)

Venting/Combustion Air Connections

⚠ DANGER ⚠

- **The vent must be installed in accordance with national and local regulations. Failure to provide proper venting could result in death, serious injury and/or property damage. This unit must be installed with a vent to the outside of the building. Safe operation of any power-vented, gas-fired equipment requires a properly operating vent system, correct provision for combustion air, and regular maintenance and inspection.**
- **Units installed in multiples require individual vent pipe runs and vent caps. Manifolding of vent runs is not permitted due to possible recirculation of combustion products into the building and back pressure effects on the combustion air proving switch.**
- **Venting must be in accordance with the National Fuel Gas Code Z223.1 or CSA B149.1 and B149.2, Installation Code for Gas Burning Appliances and Equipment, and all local codes. Local requirements supersede national requirements. Combustion air for this heater may be either taken from the space or may be ducted from the outside using the concentric adapter combustion air/vent system. Flue products must always be vented to the outdoors.**

⚠ CAUTION ⚠

Products of combustion can cause discoloration of some building finishes and deterioration of masonry materials. A clear silicone sealant normally used to protect concrete driveways may be used to protect masonry materials from discoloration and deterioration. If discoloration is an esthetic problem relocate the vent or install a vertical vent.

NOTES:

- **Installation should be done by a qualified agency in accordance with these instructions. The qualified service agency installing the vent or vent/combustion air system is responsible for the installation.**
- **The venting or venting/combustion air systems illustrated in this manual are the only ones approved for a model CAUA heater.**

DECIDE WHICH VENTING SYSTEM TO INSTALL:

- **Power-vented: a power-vented installation uses a power venter to draw combustion air from the indoor space and exhaust flue products to the outdoors. A vent cap (option CC1 or equivalent) is required.**
- **Separated-combustion: a separated-combustion installation requires a vent/combustion air system that uses a power venter to duct combustion air from outdoors and exhaust flue products to the outdoors. A vent/combustion air kit (option CC2 or CC6) is required.**

Venting/Combustion Air Requirements for Power-Vented Installations

⚠ WARNING ⚠

Do not install a unit in a confined space without providing wall openings leading to and from the space. If the environment has a positive pressure and is such that it is not detrimental to combustion air, the power-venting system in this section may be installed.

- To provide combustion air to the heater, sufficient air must enter the equipment location to replace that exhausted through the heater vent system. In the past, the infiltration of outside air assumed in heat loss calculations (one air change per hour) was assumed to be sufficient. However, current construction methods using more insulation, vapor barriers, tighter fitting and gasketed doors and windows, weather-stripping, and/or mechanical exhaust fans may now require the introduction of outside air through wall openings or ductwork to the equipment room.
- Under all conditions, enough air must be provided to ensure there will not be a negative pressure condition within the equipment room or space.
- Requirements for combustion air and ventilation air depend upon whether the unit is located in a confined or unconfined space. A ***confined*** space is defined as a space whose volume is <50 cubic feet per 1,000 BTUh of the installed appliance input rating. An ***unconfined*** space is defined as a space whose volume is ≥50 cubic feet per 1,000 BTUh of the installed appliance input rating.
- Provide openings (depending on the combustion air source) near the floor and ceiling for ventilation and air for combustion, as shown in **Figure 3** and as listed in **Table 8**.

NOTE: For further details on supplying combustion air to a confined space, refer to the National Fuel Gas Code ANSI Z223.1a (latest edition).

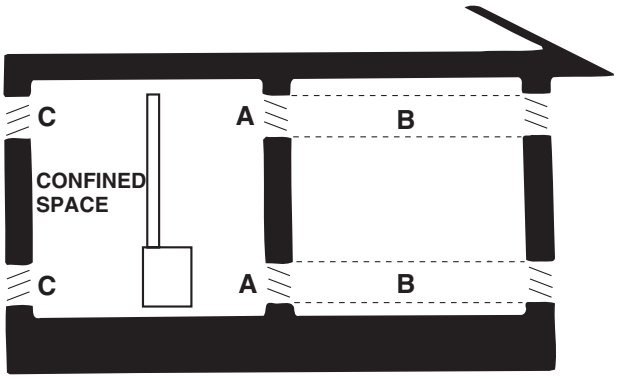


Figure 3. Confined Space Combustion Air Openings (Refer to Table 8)

Table 8. Determining Confined Space Combustion Air Requirements

Letter*	Air Source	Required Opening Size	Calculate Combustion Air Requirements
A	Air inside building	1 square inch free area per 1000 BTUh	Add total BTUh of all appliances in confined space and divide by figures at left for square inch free area size of each (top and bottom) opening
		Never <100 square inches free area for each opening	
B	Outside air through duct	1 square inch free area per 2000 BTUh	
C	Direct outside air	1 square inch free area per 4000 BTUh	

*See **Figure 3**.

- **Type of pipe:** All pipe is field supplied. Use either vent pipe approved for a Category III appliance or single-wall, 26-gauge or heavier galvanized (or a material of equivalent durability and corrosion resistance) vent pipe.

NOTE: If local code requires, a double-wall terminal section may be installed with a single-wall or Category III vent pipe run OR if at least 1/2 of the equivalent vent length is vertical, vent pipe approved for a Category I heater may be used. Single-wall pipe or double-wall (Type B) vent pipe is suitable for use with a Category I heater.

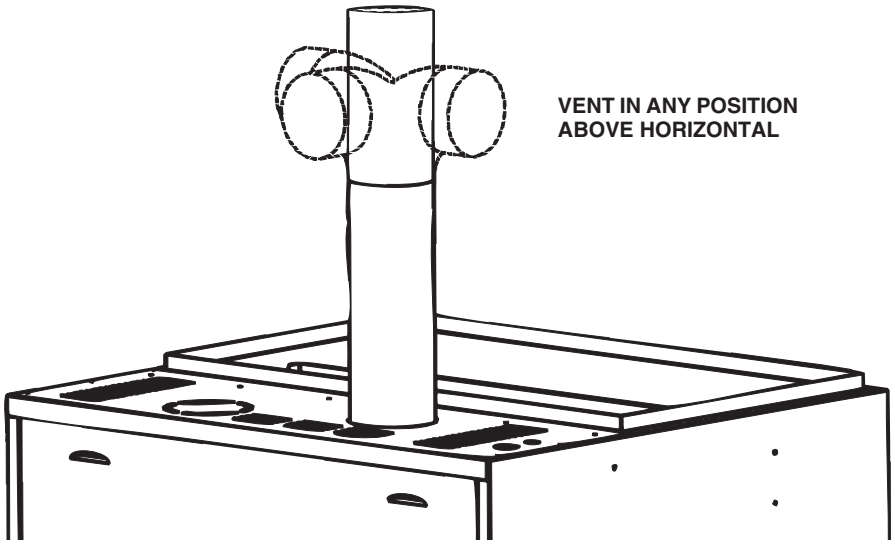
- **Venter (flue) outlet:** A minimum of 12 inches (305 mm)of straight pipe is required at the venter outlet (refer to **Table 9**) before installing an elbow in the vent system. An elbow should never be attached directly to the venter. An elbow attached to the straight pipe can be in any position at or above horizontal (see **Figure 4**, DETAIL A).

Venting/Combustion Air Connections—Continued

Venting/Combustion Air Requirements for Power-Vented Installations—Continued

Table 9. Venter Outlet Size

Unit Size	
150–250	300–400
Diameter (Inches (mm))	
5 (127)	6 (152)

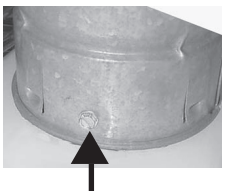


DETAIL A: ALTERNATE VENT DIRECTIONS

STEP 1: PLACE CONTINUAL 1/4-INCH BEAD OF SILICONE SEALANT AROUND CIRCUMFERENCE OF VENTER OUTLET COLLAR.

PERFORM STEP 2 IMMEDIATELY AFTER STEP 1.

STEP 2: SLIDE DOUBLE-WALL PIPE OVER COLLAR SO THAT COLLAR IS INSIDE INNER PIPE. PUSH DOUBLE-WALL PIPE TIGHT TO HEATER CABINET. TO SECURE CONNECTION, SPACED EQUAL DISTANCE AROUND PIPE, DRILL AND INSERT THREE 3/4-INCH-LONG SHEET METAL SCREWS THROUGH PIPE AND INTO COLLAR. DO NOT OVER TIGHTEN SCREWS.



DETAIL B: CONNECTING DOUBLE-WALL (TYPE B) VENT PIPE TO VENTER OUTLET

Figure 4. Vent Pipe for Power-Vented Installations

NOTES:

- **Do not install dampers or any other type of flue restrictor device.**
- **If installing a double-wall vent run (allowed if half of the vent length is vertical), see Figure 4, DETAIL B.**

- **Vent pipe diameter and length (refer to Table 10):** If the system contains all vertical pipe or a combination of horizontal and vertical vent pipe, the maximum permissible vent length may be increased 1 foot (305 mm) for each foot (305mm) of vertical rise up to a maximum increase of 10 feet (3 meters).

Table 10. Vent Pipe Diameter and Length for Power-Vented Installations

Description	Unit Size	
	150–250	300–400
Diameter (Inches (mm))		
Vent pipe	5 (127)	6 (152)
Length (Feet (Meters))		
Minimum	5 (1.5)	
Maximum	50 (15.2)	
Equivalent straight length for 45-degree elbow	2.5 (0.8)*	
Equivalent straight length for 90-degree elbow	5 (1.5)*	
*Reduce by this amount for each elbow.		

- **Joints and sealing:**
  a. If using single wall, 26-gauge or heavier galvanized pipe, secure slip-fit connections using sheet metal screws or rivets. Seal pipe joints either with tape suitable for 550°F (such as option FA1, PN 98266) or high-temperature silicone sealant.
  b. If using Category III vent pipe, follow pipe manufacturer's instructions for joining pipe sections. When attaching Category III pipe to the venter outlet or the vent cap, make secure, sealed joints following a procedure that best suits the style of Category III pipe being used.
  c. If installing a double-wall (Type B) terminal pipe, follow the instructions in **Figure 5** to join the double-wall pipe to a single-wall or Category III vent pipe run. To attach the vent cap, follow instructions in **Figure 6**.
  d. If using double-wall (Type B) vent pipe in the vent pipe run (at least half of the equivalent vent length must be vertical), follow the pipe manufacturer's instructions for joining pipe sections. For attaching double-wall pipe to the heater, see **Figure 4**, DETAIL B). To attach the vent cap, see **Figure 6**.

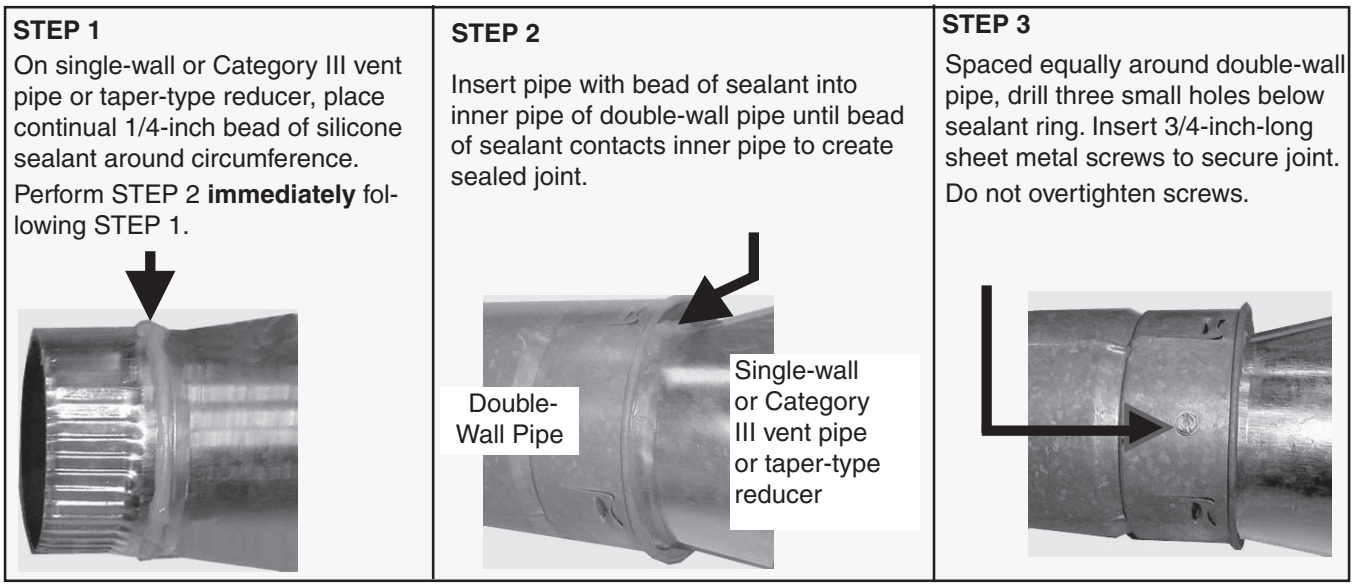
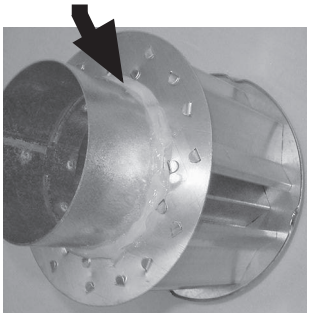


Figure 5. Joining Double-Wall (Type B) Pipe to Single-Wall or Category III Vent Pipe

Venting/Combustion Air Connections—Continued

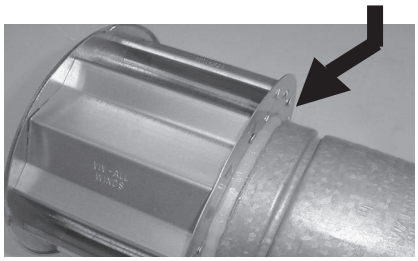
Venting/Combustion Air Requirements for Power-Vented Installations—Continued

STEP 1: PLACE CONTINUAL 3/8-INCH BEAD OF SILICONE SEALANT AROUND CIRCUMFERENCE OF VENT CAP COLLAR TO PREVENT ANY WATER INSIDE VENT CAP FROM RUNNING DOWN DOUBLE-WALL PIPE.



PERFORM STEP 2 IMMEDIATELY FOLLOWING STEP 1.

STEP 2: INSERT COLLAR ON VENT CAP AS FAR AS POSSIBLE INSIDE INNER WALL OF DOUBLE-WALL PIPE. ADD ADDITIONAL SILICONE SEALANT TO FULLY CLOSE ANY GAPS BETWEEN VENT CAP AND DOUBLE-WALL PIPE TO PREVENT WATER FROM ENTERING DOUBLE-WALL PIPE.



STEP 3: SECURE VENT CAP TO DOUBLE WALL PIPE BY DRILLING AND INSERTING 3/4-INCH-LONG SHEET METAL SCREW INTO VENT CAP COLLAR. DO NOT OVER TIGHTEN SCREW.

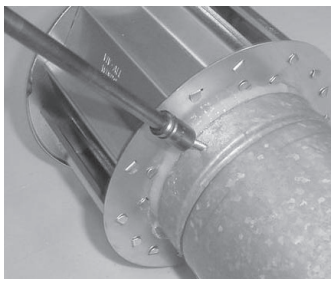


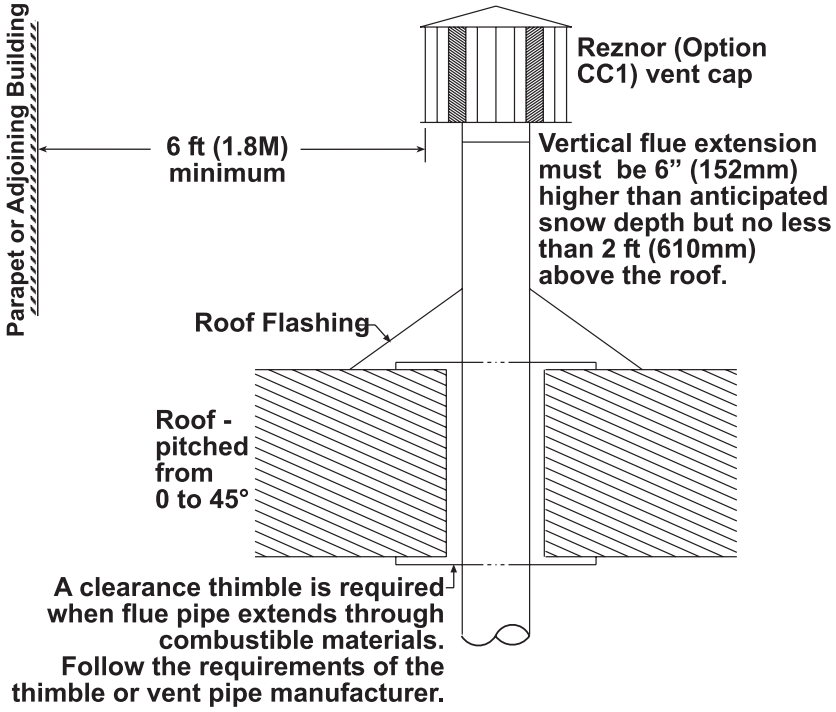
Figure 6. Joining Double-Wall (Type B) Pipe to Vent Cap

- **Vent system support:** Use non-combustible supports on vent pipe. Support horizontal runs every 6 feet (1.8 meters). Support vertical runs of Type B double-wall or Category III vent pipe in accordance with the requirements of the pipe manufacturer. Support vertical single-wall pipe in accordance with accepted industry practices. Do not rely on the heater for support of either horizontal or vertical vent pipe.
- **Condensation:** Any length of single-wall vent pipe exposed to cold air or run through an unheated area or an area with an ambient temperature of 45°F or less must be insulated along its entire length with a minimum of 1/2 inch foil-faced fiberglass, 1-1/2# density insulation. Where extreme conditions are anticipated, install a means of condensate disposal.
- **Vent terminal (pipe and vent cap):** The vent system must be terminated with the type of vent cap approved for use with this heater. The vent cap must be the same size as the vent pipe. Use of the vent cap available with the heater (option CC1) is recommended. A different style vent cap could cause nuisance problems or unsafe conditions.

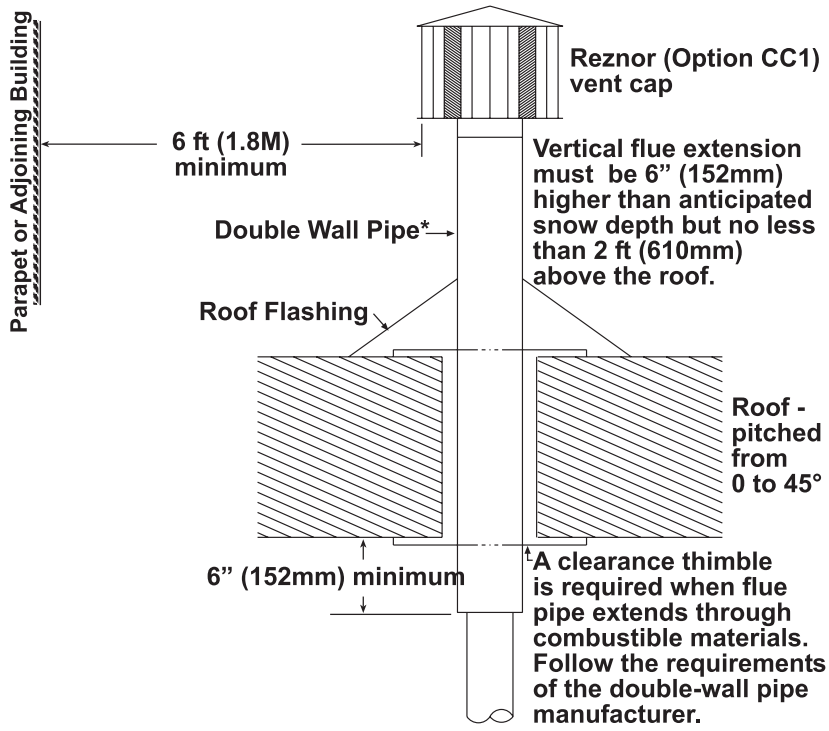
NOTE: The vent terminal pipe may be either single-wall or double-wall (Type B).

- **Vent terminal options:** Vent terminals for power-vented installations using the option CC1 vent cap are shown in **Figure 7** (vertical vent configurations) and **Figure 8** (horizontal vent configurations). Refer to **Table 11** for horizontal vent terminal clearances.

NOTE: A vent cap is required. Maintain a clearance of 12" (305mm) from the wall to the vent terminal cap for stability under wind conditions.



SINGLE-WALL VENT RUN AND SINGLE-WALL TERMINAL



SINGLE-WALL VENT RUN AND DOUBLE-WALL TERMINAL

Figure 7. Vertical Vent Terminal—Power-Vented Installations

Venting/Combustion Air Connections—Continued

Venting/Combustion Air Requirements for Power-Vented Installations—Continued

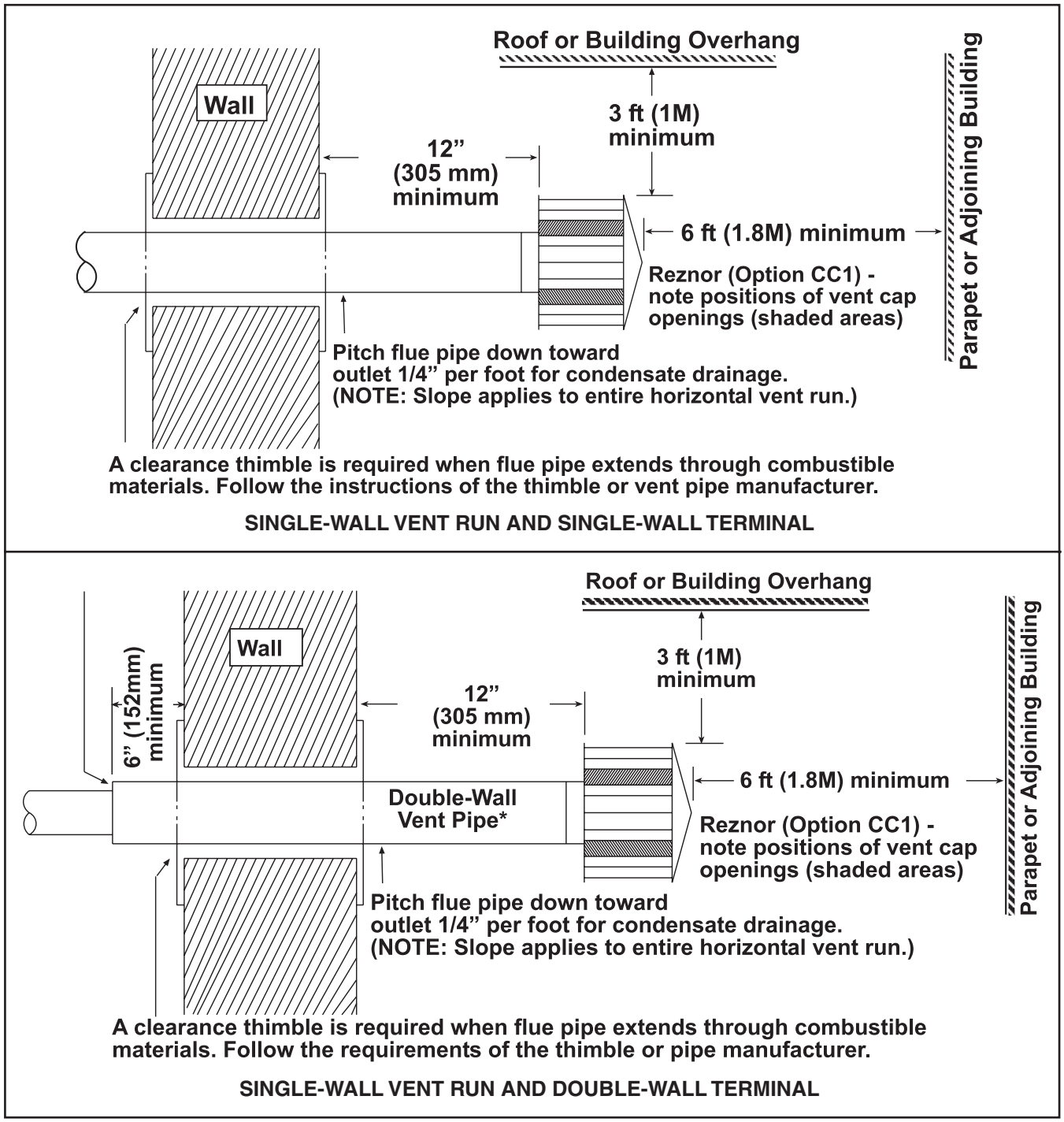


Figure 8. Horizontal Vent Terminal—Power-Vented Installations

Table 11. Minimum Clearance Requirements for Horizontal Vent Terminal	
Component/Structure	**Minimum Clearance, All Directions Unless Specified (Feet (Meters))**
Forced air inlet within 10 feet (3.1 meters)*	3 (0.9) above
Combustion air inlet of another appliance	6 (1.8)
Mechanical air supply inlet to any building	Canada: 6 (1.8)
Any building opening (door, window, or gravity air inlet)	4 (1.2) horizontal and below
	1 (0.3) above
Gas meter,** electric meter, and relief equipment	US: 4 (1.2) horizontal
	Canada: 6 (1.8) horizontal
Gas regulator**	US: 3 (0.9) horizontal
	Canada: 6 (1.8) horizontal
Adjoining building or parapet	6 (1.8)
Adjacent public walkway	7 (2.1) above
Grade (ground level)	3 (0.9) above
*Does not apply to the inlet of a direct vent appliance.	
**Do not terminate the vent directly above a gas meter or service regulator.	

Venting/Combustion Air Requirements for Separated-Combustion Installations

- **Venter outlet and combustion air pipe collars (refer to Table 12):** A minimum length of 12 inches (305 mm) of straight pipe is always required at the venter outlet. For the combustion air inlet collar, use tin snips or aviation shears to cut out the hole in the top of the heater (see **Figure 9**). Insert the pipe down through the hole and attach it to the collar inside the heater. Seal the joint. Larger size heaters have oval collars. If the collar is oval, form the pipe to fit the collar.

Table 12. Venter Outlet and Combustion Air Inlet Sizes			
Collar	**Unit Size**		
	150, 200	**250**	**300–400**
	Diameter (Inches (mm))		
Venter outlet	5 (127)	5 (127)	6 (152)
Combustion air inlet		6 (152)	

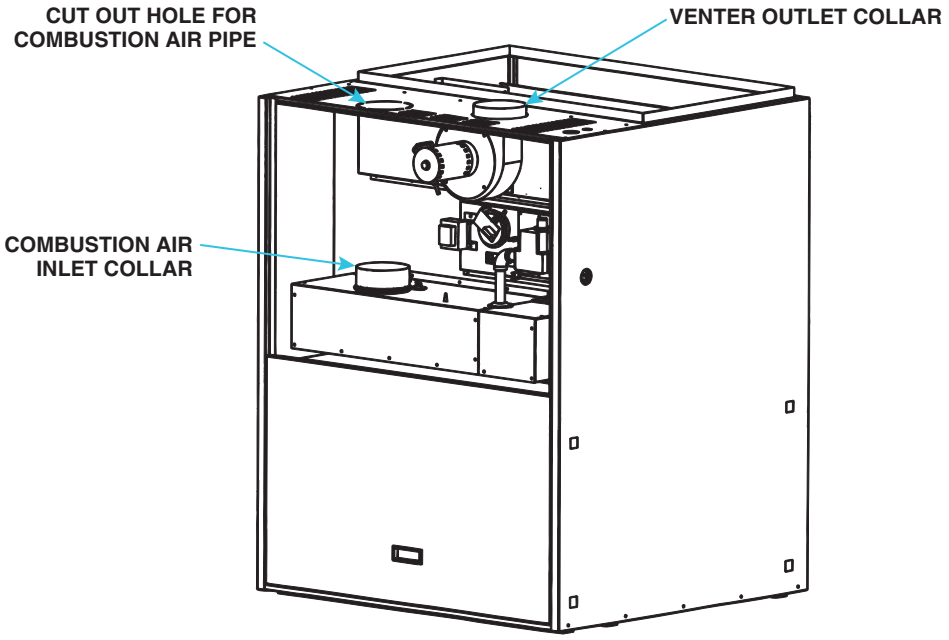


Figure 9. Venter Outlet and Combustion Air Pipe Collars

Venting/Combustion Air Connections—Continued

Venting/Combustion Air Requirements for Separated-Combustion Installations—Continued

- **Piping:** All pipe is field-supplied. Requirements for both the vent pipe and the combustion air inlet pipe are as follows:
  a. **Vent pipe:** Vent pipe approved for a Category III appliance OR single-wall, 26-gauge or heavier galvanized (or a material of equivalent durability and corrosion resistance) vent pipe is required between the heater and the concentric adapter box. Double-wall (Type B) vent pipe is required for the vent terminal section. The length of vent pipe that extends through the box and runs concentric through the combustion air pipe must be one piece with no joints.
  b. **Combustion air pipe:** Sealed, single-wall galvanized pipe is recommended for combustion air.
  c. **Pipe length and diameter:** Vent pipe diameters and maximum indoor vent lengths apply to both horizontal and vertical vents. Pipe diameter and length requirements are listed in **Table 13**.

NOTE: Add all straight sections and equivalent lengths for elbows. The total length of the straight sections and elbows must not exceed the maximum length.

Table 13. Vent Pipe Diameter and Length for Separated-Combustion Installations

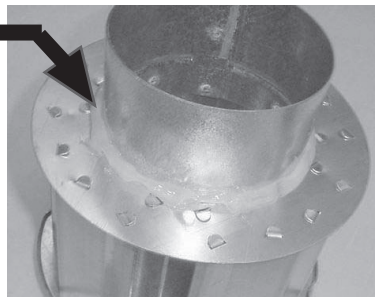
Type	Description	Unit Size		
		150, 200	250	300–400
Diameter (Inches (mm))				
Pipe from heater to concentric adapter box	Vent pipe	5 (127)	5 (127)	6 (152)
	Inlet air pipe		6 (152)	
Concentric (outdoor terminal) pipes	Vent pipe	4 (102)	5 (127)	5 (127)
	Inlet air pipe	6 (152)	8 (203)	8 (203)
Length (Feet (Meters))				
Pipe from heater to concentric adapter box	Minimum	5 (1.5)		
	Maximum	40 (12.2)	50 (15.2)	50 (15.2)
	Equivalent straight length for 45-degree elbow	2.5 (0.8)		
	Equivalent straight length for 90-degree elbow	5 (1.5)		

- **Clearance:** Do not enclose the vent pipe or place pipe closer than 6 inches (152 mm) to combustible material.
- **Condensation:** Any length of single-wall vent pipe exposed to cold air or run through an unheated area or an area with an ambient temperature of 45°F or less must be insulated along its entire length with a minimum of 1/2 inch foil-faced fiberglass, 1-1/2# density insulation. Where extreme conditions are anticipated, install a means of condensate disposal.
- **Joints and sealing:** Seal pipe joints as follows:
  a. **To seal joints in Category III vent pipe:** Follow the pipe manufacturer's instructions for joining and sealing Category III vent pipe sections.
  b. **To seal joints in single-wall vent or combustion air pipe:** Secure slip-fit pipe connections using sheet metal screws or rivets. Seal all joints with aluminum tape or silicone sealant.
  c. **To seal the joint in two terminal sections of double-wall vent pipe in a vertical vent:** Follow the pipe manufacturer's instructions for joining and sealing double-wall vent pipe sections.
  d. **To seal the joint between the terminal section of double-wall vent pipe and a single-wall or Category III vent pipe:** follow the illustrated step-by-step instructions in **Figure 5**. Make this connection no more than 6 inches (152 mm) from the concentric adapter box.
  e. **To seal the joint between the terminal section of double-wall vent pipe and the vent cap:** Follow the illustrated step-by-step instructions in **Figure 10**.

STEP 1

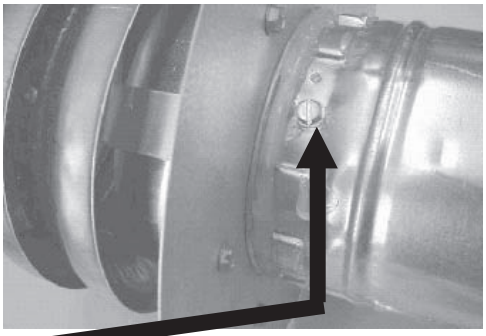
Place continual 3/8-inch bead of silicone sealant around circumference of vent cap collar to prevent any water inside vent cap from running down double-wall pipe.

Perform STEP 2 **immediately** following STEP 1.



STEP 2

Insert collar on vent cap as far as possible inside inner wall of double-wall pipe. Add additional silicone sealant to fully close any gaps between vent cap and double-wall pipe. This is necessary to prevent water from entering double wall pipe.



STEP 3

Secure vent cap to double-wall pipe by drilling and inserting 3/4-inch-long sheet metal screw into vent cap collar. Do not overtighten screw.

Figure 10. Joining Double-Wall (Type B) Pipe to Vent Terminal Cap (Horizontal or Vertical)

- **Support:** Support horizontal runs every 6 feet (1.8 meters). Support vertical runs of Type B double-wall or Category III vent pipe in accordance with the requirements of the pipe manufacturer. Support single-wall vertical pipe in accordance with accepted industry practices. Do not rely on the heater or the adapter box for support of either horizontal or vertical pipes. Use noncombustible supports on vent pipe.

NOTE: The double-wall vent terminal pipe does not attach to the concentric adapter box and must be supported during installation.

- **Concentric adapter box:** The concentric adapter box is included in the vent/combustion air kit. Installation instructions depend on whether the vent system is horizontal (option CC6) or vertical (option CC2). All separated-combustion installations require a concentric adapter box as shown in **Figure 11**.

Venting/Combustion Air Connections—Continued

Venting/Combustion Air Requirements for Separated-Combustion Installations—Continued

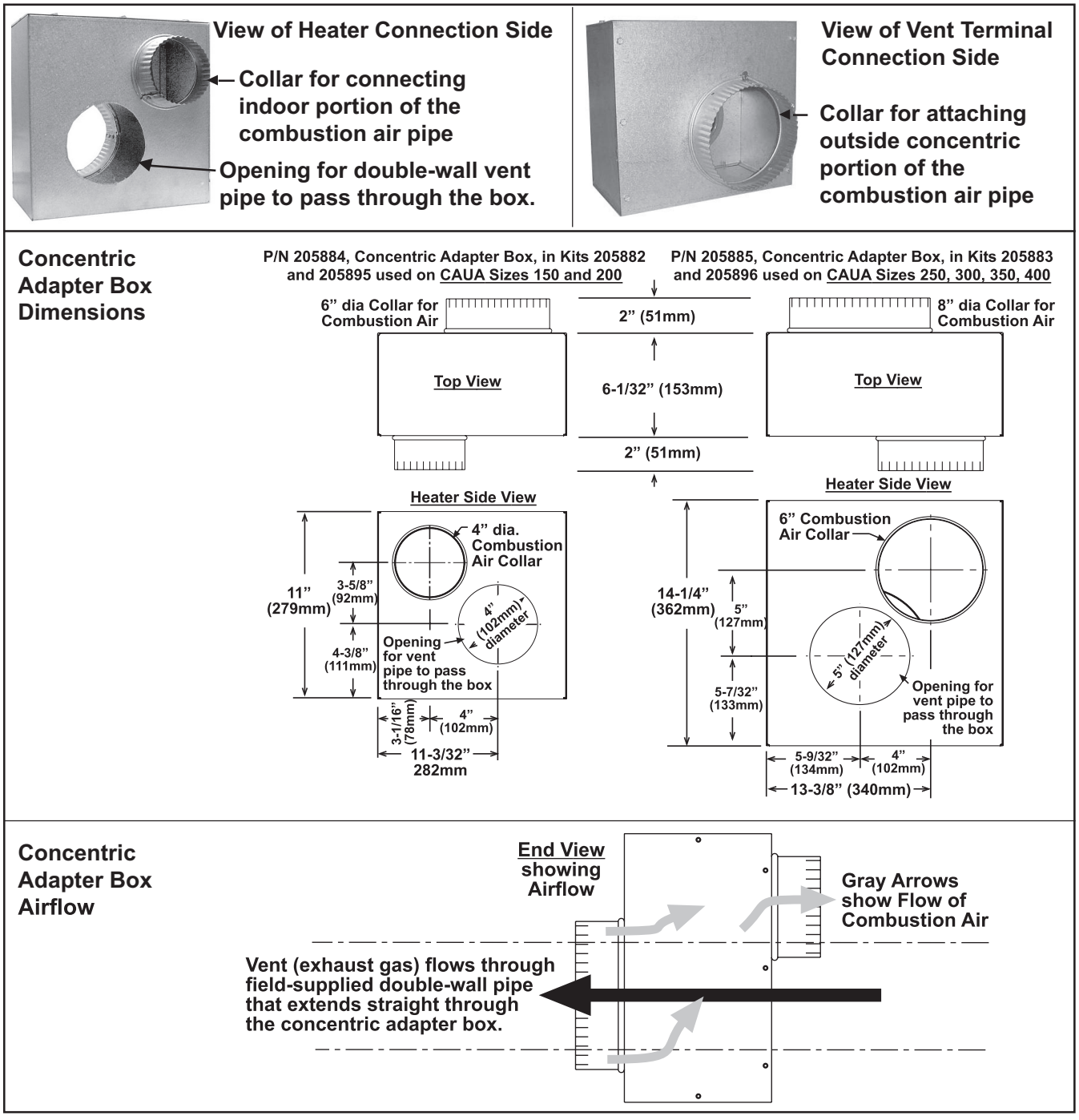


Figure 11. Concentric Adapter Box

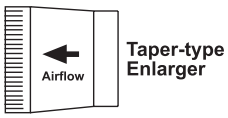
- **Concentric adapter box pipe connections:** When pipe diameters differ, depending on direction of airflow, join the pipes with either a tapered reducer or enlarger as shown in **Figure 12**.

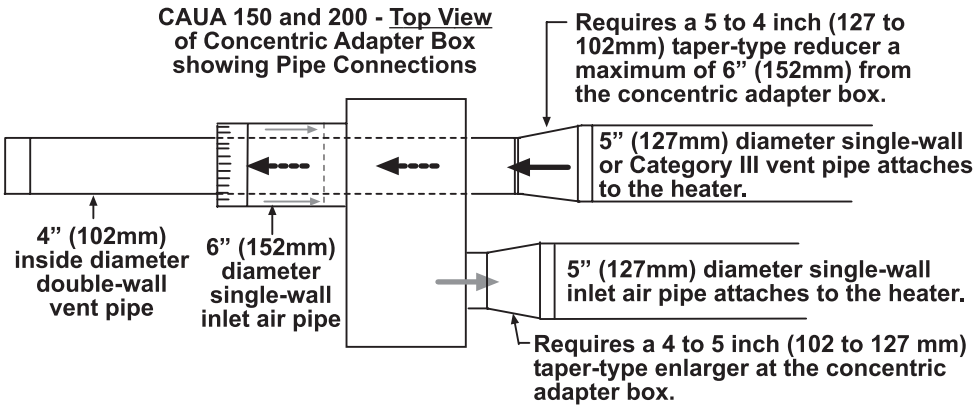
NOTE: Do NOT make actual connections until after reading the instructions and length requirements for installing the vent/combustion air kit. The connection requirements are the same for both vertical and horizontal systems, but pipe length requirements vary.

Unit Sizes 150 and 200

- CAUA Sizes 150 and 200 always require a 5” to 4” (127 to 102 mm) reducer in the vent pipe.

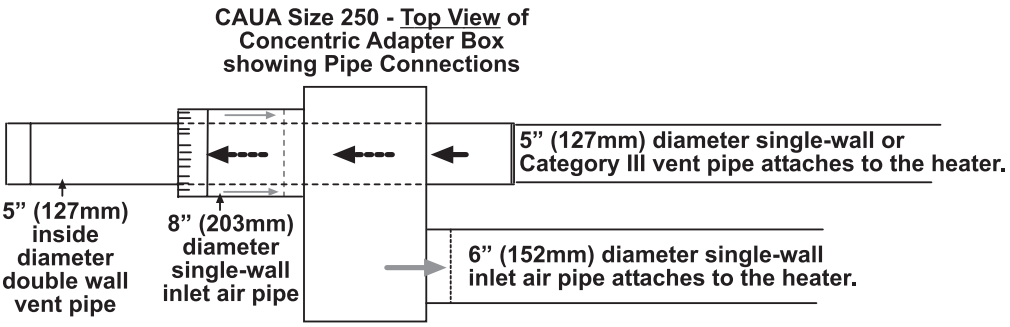
- CAUA Sizes 150 and 200 always require a 4” to 5” (102 to 127mm) enlarger for attaching combustion air pipe.





Unit Size 250

- Pipe diameters do not differ; no taper-type connectors are required.



Unit Sizes 300, 350, and 400

- CAUA Sizes 300, 350, and 400 always require a 6” to 5” (152 to 127 mm) reducer in the vent pipe.

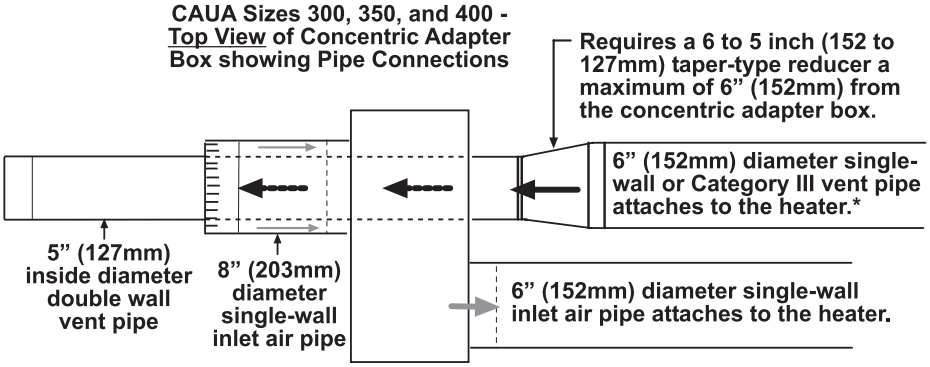
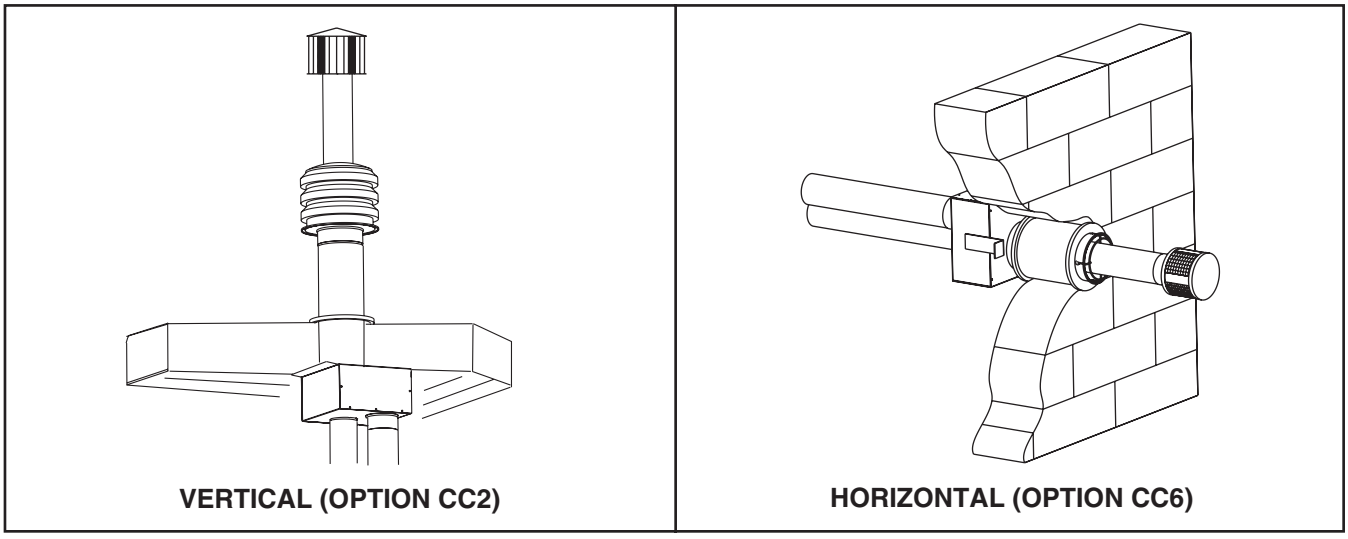


Figure 12. Concentric Adapter Box Connections

- **Vent terminal options:** Vent terminal options CC2 (vertical vent configuration) and CC6 (horizontal vent configuration) for separated-combustion installations are shown in **Figure 13**.

Venting/Combustion Air Connections—Continued

Venting/Combustion Air Requirements for Separated-Combustion Installations—Continued



VERTICAL (OPTION CC2)

HORIZONTAL (OPTION CC6)

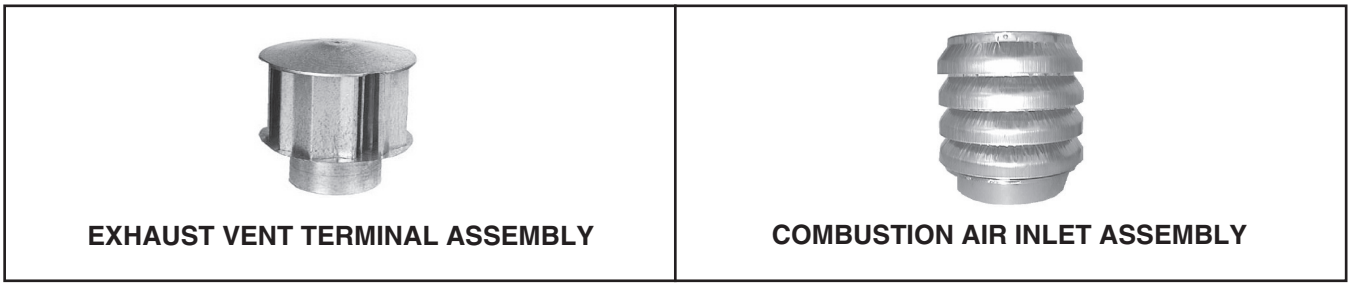
Figure 13. Horizontal and Vertical Venting Options—Separated-Combustion Installations

Vertical Vent Terminal for Separated-Combustion Installations (Option CC2)

- Field-supplied components required for installation of the vertical vent kit are as follows:
  a. Vent and combustion air piping in accordance with **Table 13**
  b. Tapered vent pipe diameter reducers and/or increasers, as required
  c. Thimble (not required if wall is of non-combustible construction)
  d. Flashing
  e. Sheet metal screws, tape, and sealant, as required
- Factory-supplied components for installation of the vertical vent kit are listed in **Table 14**.

Table 14. Vertical Vent Terminal/Combustion Air Package (Option CC2) Components

Unit Size		Description	Quantity
150, 200	250–400		
Kit PN			
205895	205896		
Component PN			
205884	205885	Concentric adapter box (see **Figure 11**)	1
110051	110052	Exhaust vent terminal assembly (see **Figure 14**)	1
155635	53330	Combustion air inlet assembly (see **Figure 14**)	1
207232		Concentric adapter box bracket	2
53335		High-temperature silicone sealant, tube	1



EXHAUST VENT TERMINAL ASSEMBLY

COMBUSTION AIR INLET ASSEMBLY

Figure 14. Option CC2 Components

⚠ DANGER ⚠

To prevent combustion products from entering the occupied space, all vent terminals must be positioned or located away from fresh air intakes, doors, and windows. Failure to comply could result in severe personal injury or death and/or property damage.

1. Determine vent terminal location on roof:
   a. Select location away from fresh air intakes, allowing space for concentric adapter box inside.
   b. Vent terminal must be located away from adjacent buildings as shown in **Figure 15**.

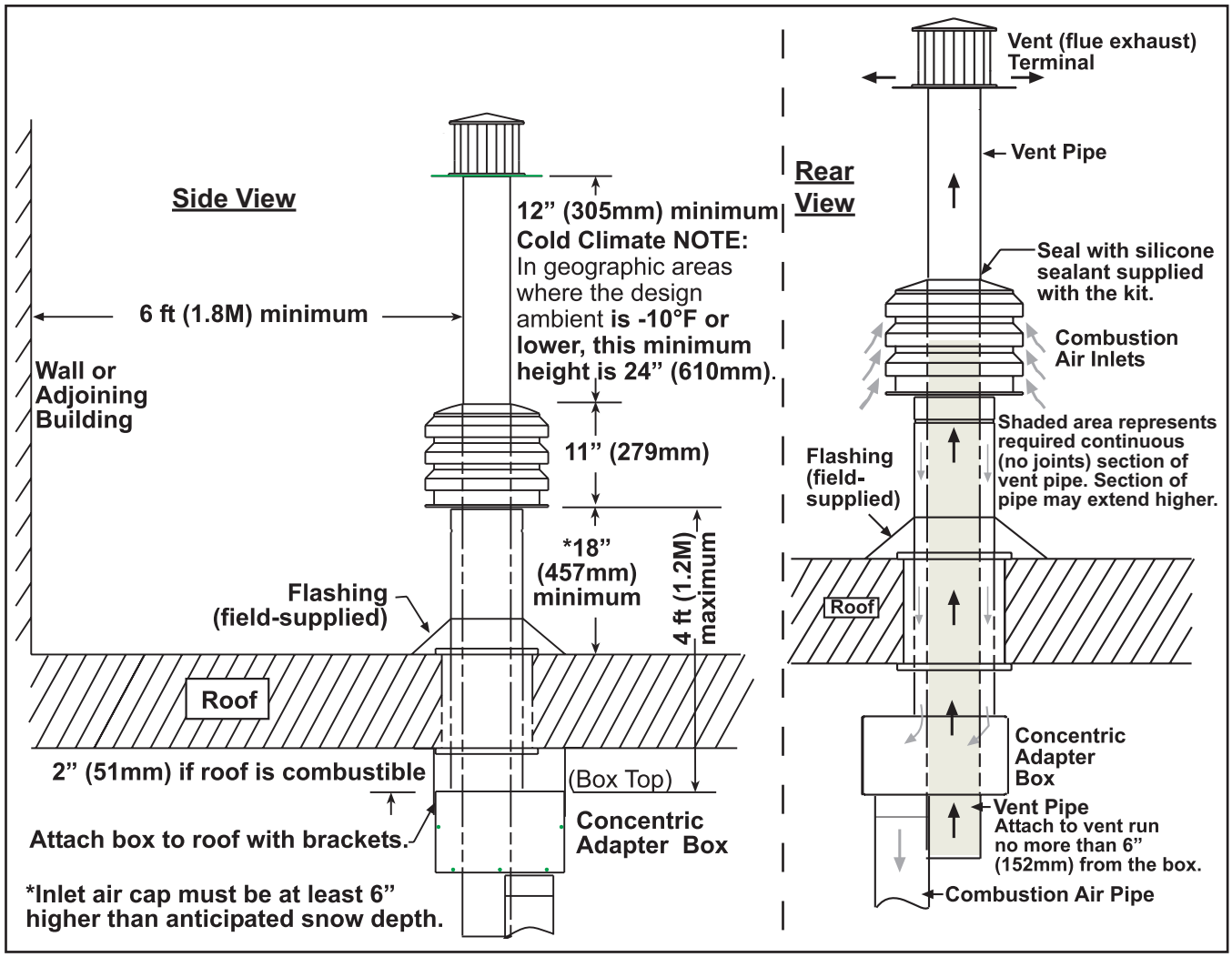


Figure 15. Option CC2 Installation

2. Install vent pipe and combustion air pipe runs in accordance with specifications listed in **Venting/Combustion Air Requirements for Separated-Combustion Installations** section:
   a. Connect piping to heater.
   b. Seal all joints. Due to high temperature considerations, do not enclose exhaust pipe or place pipe closer than 6 inches (152 mm) to combustible material.
   c. Extend piping runs close to roof at location selected in step 1 and support piping.

NOTE: The vent pipe will extend through the roof after the concentric adapter box is installed. The indoor combustion air pipe will end at the box.

Venting/Combustion Air Connections—Continued

Vertical Vent Terminal for Separated-Combustion Installations (Option CC2)—Continued

3. Cut hole through roof for combustion air pipe:
   a. Ensure that location and orientation of concentric adapter box are correct and mark and cut hole.
   b. Ensure that hole accommodates combustion air pipe—6-inch (152-mm) for unit size 150 or 200 or 8-inch (203-mm) for unit size 250, 300, 350, or 400. Thimble may be required depending on building construction and/or local codes. Larger diameter combustion air pipe serves as clearance for vent pipe on non-combustible construction.
4. Secure longer angles on concentric adapter box brackets (see **Figure 16**) to concentric adapter box.

NOTE: The longer angle of the concentric adapter box bracket has five 7/32-inch holes that allow the position of the bracket on the box to be adjusted. The shorter angle has three 7/32-inch holes that allow adjustment to construction.

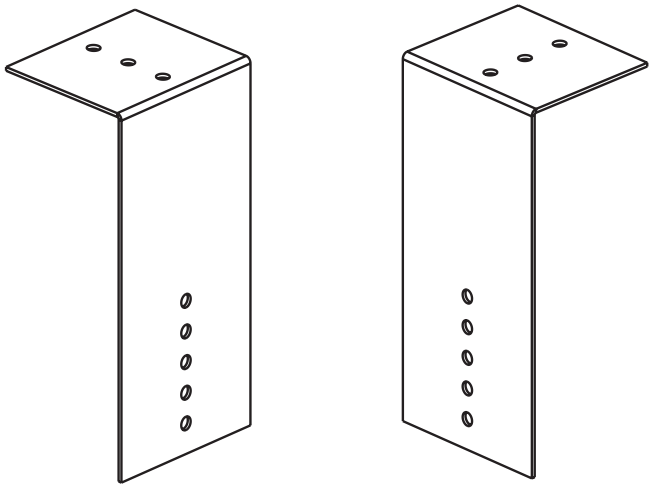


Figure 16. Concentric Adapter Box Brackets

5. Connect outside section of combustion air pipe to concentric adapter box (see **Figure 17**):
   a. Determine length of combustion air pipe so that dimension X in **Figure 17** is equal to bracket length plus roof thickness and plus anticipated snow depth. Ensure that length of combustion air pipe does not exceed 48 inches (1,219 mm) or does not extend ***less than*** 18 inches (457 mm) above roof.
   b. Secure inlet air pipe to collar of concentric adapter box using sheet metal screws. Seal joint and seam using tape or sealant.
6. Secure concentric adapter box to underside of roof (see **Figure 17**):

⚠ CAUTION ⚠

- **If the roof is combustible, ensure that brackets are positioned to allow a 2-inch (51 mm) clearance between the concentric adapter box and the roof.**
- **If any holes are made in the concentric adapter box in error, ensure that they are sealed.**

   a. Insert combustion air pipe through roof as shown in **Figure 18**.
   b. Position concentric adapter box to match pipe runs and secure short angles of concentric adapter brackets (see **Figure 16**) to underside of roof using field-supplied hardware.
   c. Install field-supplied flashing around combustion air pipe on roof outside.

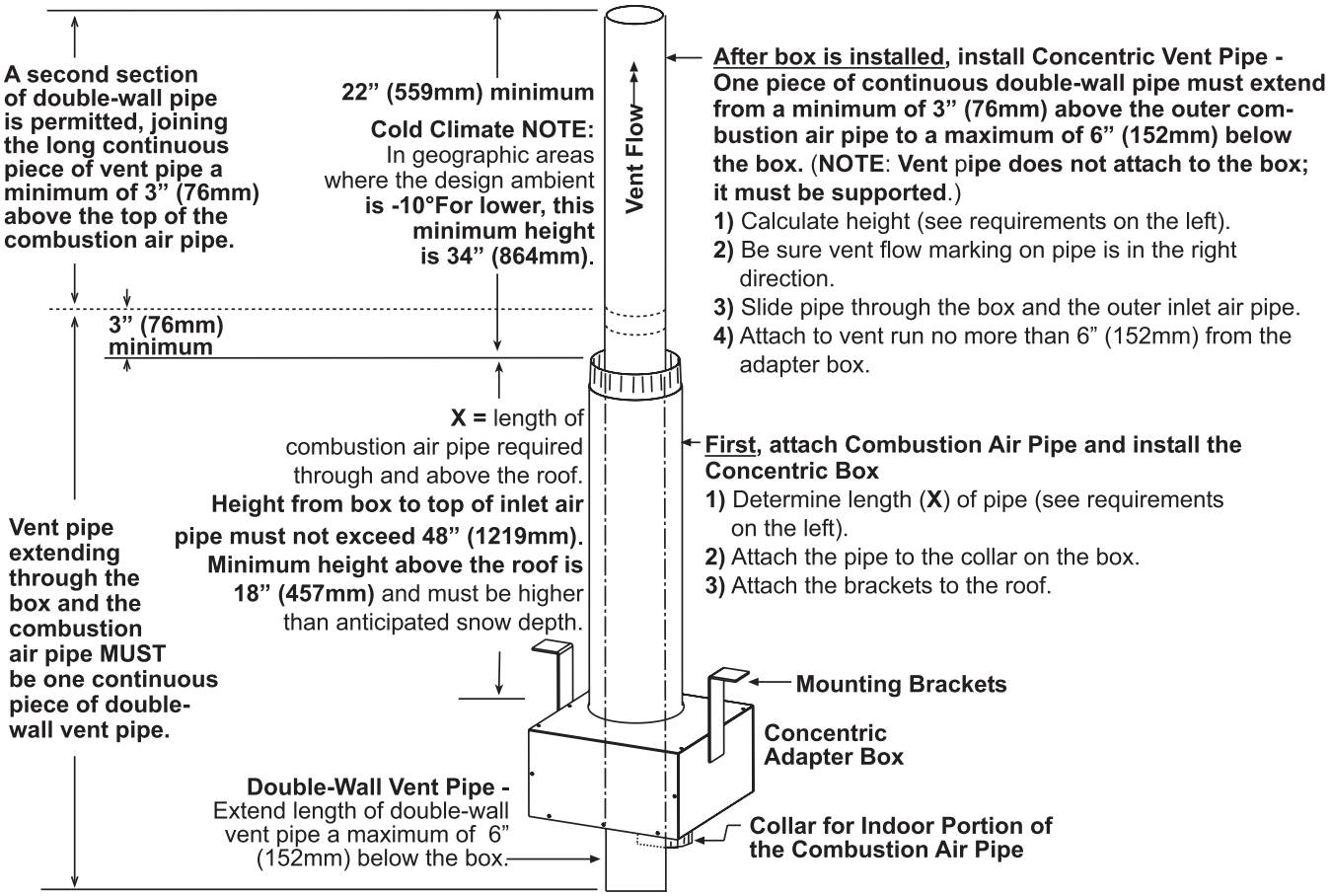


Figure 17. Combustion Air Pipe Installation

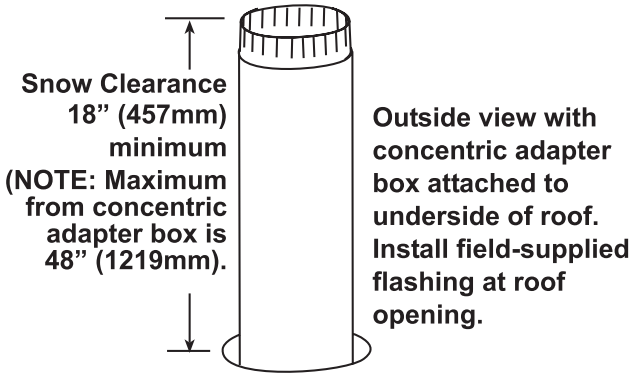


Figure 18. Combustion Air Pipe Through Roof

Venting/Combustion Air Connections—Continued

Vertical Vent Terminal for Separated-Combustion Installations (Option CC2)—Continued

7. Install double-wall terminal vent pipe:

NOTE: The length of the vent pipe is determined by the installation within maximum and minimum requirements. The vent pipe extending through the box and the inlet air pipe must be one piece of double-wall vent pipe without joints.

a. Refer to **Figure 17** to determine lengths of each pipe segment and to calculate total length required. Determine length by adding requirements:
   (1) Starting at bottom, vent pipe can extend maximum of 6 inches (152 mm) below box
   (2) Plus 6 inches (152 mm) through box
   (3) Plus length of brackets above box
   (4) Plus width of roof
   (5) Plus height of outside combustion air pipe above roof
   (6) Plus mimimum of 3 inches (76 mm) beyond top of inlet air pipe
   (7) Total is mimimum length of vent pipe section—if actual piece of vent pipe is longer, extend it farther above combustion air pipe—do not extend it more than 6 inches (152 mm) below box

b. Ensure that double-wall terminal vent pipe is in proper direction and slide end of pipe into box and out through combustion air pipe. Position vent pipe to lengths determined above.

NOTE: The double-wall vent pipe does not attach to the box. The installer must provide support.

c. Connect double-wall vent pipe to single-wall or Category III vent pipe run using tapered reducer in accordance with **Figure 5**.

d. Seal completely around circumference of pipe and opening of box using silicone sealant.

8. Install combustion air inlet (see **Figure 19**):

a. On outside, slide combustion air inlet over vent pipe and fasten collar to combustion air pipe using sheet metal screws.

b. Seal opening at top between vent pipe and combustion air inlet to prevent water leakage using silicone sealant.

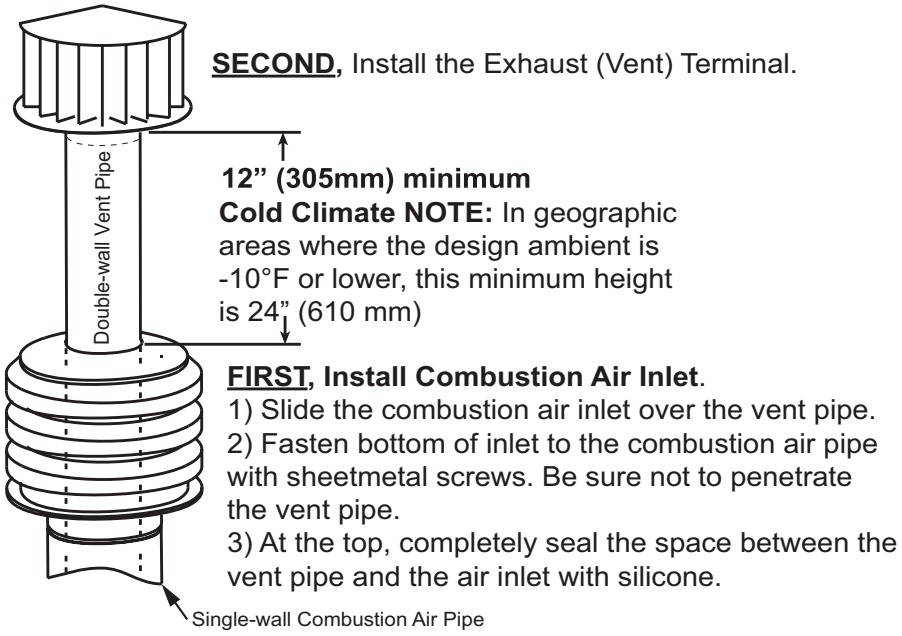


Figure 19. Combustion Air Inlet and Vent Terminal Installation

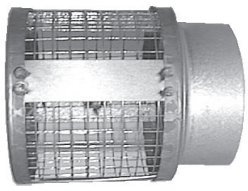
9. Install exhaust vent terminal (see **Figure 19**) in accordance with **Figure 10**.
10. Install indoor combustion air pipe:
    a. Secure single-wall combustion air pipe run to collar on concentric adapter box using sheet metal screws. For unit sizes 150 and 200, install tapered enlarger as shown in **Figure 12**.
    b. Seal pipe joints with tape or sealant.
11. Verify compliance with **Figure 15** and with all specific venting requirements listed above.

Horizontal Vent Terminal for Separated-Combustion Installations (Option CC6)

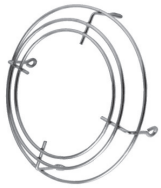
- Field-supplied components required for installation of the horizontal vent kit are as follows:
    a. Vent and combustion air piping in accordance with **Table 13**
    b. Tapered vent pipe diameter reducers and/or increasers, as required
    c. Thimble (not required if wall is of non-combustible construction)
    d. Flashing
    e. Sheet metal screws, tape, and sealant, as required
- Factory-supplied components for installation of the horizontal vent kit are listed in **Table 15**.

Table 15. Horizontal Vent Terminal/Combustion Air Package (Option CC6) Components

Unit Size		Description	Quantity
150, 200	250–400		
Kit PN			
205882	**205883**		
Component PN			
205884	205885	Concentric adapter box (see **Figure 11**)	1
155096	53316	Assembly, screened exhaust (see **Figure 20**)	1
205893	205894	Inlet guard (see **Figure 20**)	1
37661		Screw, sheet metal, #10-16 × 1/2	4
207232		Concentric adapter box bracket	2
53335		High-temperature silicone sealant, tube	1



SCREENED EXHAUST ASSEMBLY



INLET GUARD

Figure 20. Option CC6 Components

⚠ DANGER ⚠

- **To prevent combustion products from entering the occupied space, all vent terminals must be positioned or located away from fresh air intakes, doors, and windows. Failure to comply could result in severe personal injury or death and/or property damage.**
- **In climates with below freezing temperatures, condensate may form icicles on the vent terminal. Locate the terminal where falling icicles do not present a hazard.**
- **Consider local snow depth conditions. The vent must be at least 6 inches (152 mm) above the anticipated snow depth.**

Venting/Combustion Air Connections—Continued

1. Horizontal Vent Terminal for Separated-Combustion Installations (Option CC6)—Continued

1. Determine vent terminal location on outside wall:
   a. Refer to **Table 13** to ensure that location complies with vent length requirements.
   b. For most applications, ensure that vent terminal is level with heater mounting height.
   c. Allow downward pitch of 1/4-inch per foot (6 mm per 305 mm) for condensate drain.

NOTE: Local codes supersede all provisions in these instructions and in *National Fuel Gas Code* Z223.1.

   d. Ensure that distance of vent terminal from adjacent public walkways and buildings and window and building openings complies with local codes. Absent any local codes, distance must comply with *National Fuel Gas Code* Z223.1.

⚠ WARNING ⚠

Avoid positioning the vent terminal above a walkway as there may be a small amount of condensate that drips from the end of the vent/combustion air terminal. In cold climates, the condensate may form ice.

   e. Refer to **Table 11** to ensure that location complies with minimum clearance requirements.

2. Install vent pipe and combustion air pipe runs in accordance with specifications listed in **Venting/Combustion Air Requirements for Separated-Combustion Installations** section:
   a. Connect piping to heater.
   b. Seal all joints. Due to high temperature considerations, do not enclose exhaust pipe or place pipe closer than 6 inches (152 mm) to combustible material.
   c. Extend piping runs close to wall location selected in step 1 and support piping.
3. Cut hole through outside wall for combustion air pipe.
   a. Ensure that outside wall construction thickness is between 1 inch (25 mm) minimum and 48 inches (1,219 mm) maximum.
   b. Ensure that hole accommodates combustion air pipe—6-inch (152-mm) for unit size 150 or 200 or 8-inch (203-mm) for unit size 250, 300, 350, or 400. Thimble may be required depending on building construction and/or local codes. Larger diameter combustion air pipe serves as clearance for vent pipe on non-combustible construction.
4. Secure longer angles on concentric adapter box brackets (see **Figure 16**) to concentric adapter box.

NOTE: The longer angle of the concentric adapter box bracket has five 7/32-inch holes that allow the position of the bracket on the box to be adjusted. The shorter angle has three 7/32-inch holes that allow adjustment to construction.

5. Connect outside section of combustion air pipe to concentric adapter box (see **Figure 21**):
   a. Determine length of combustion air pipe as follows:
      (1) Bracket length from box to wall
      (2) Plus wall thickness
      (3) Plus 2 inches (51 mm) beyond wall
   b. Secure inlet air pipe to collar of concentric adapter box using sheet metal screws. Seal joint and seam using tape or sealant.

6. Secure concentric adapter box to wall (see **Figure 21**):

⚠ CAUTION ⚠

- **If the wall is combustible, ensure that brackets are positioned to allow a 2-inch (51 mm) clearance between the concentric adapter box and the wall.**
- **If any holes are made in the concentric adapter box in error, ensure that they are sealed.**

a. Insert combustion air pipe out through wall.

b. Secure short angles (see **Figure 21**) of concentric adapter box brackets to wall.

c. Seal or flash inlet air pipe on outside using sealant and/or field-supplied flashing.

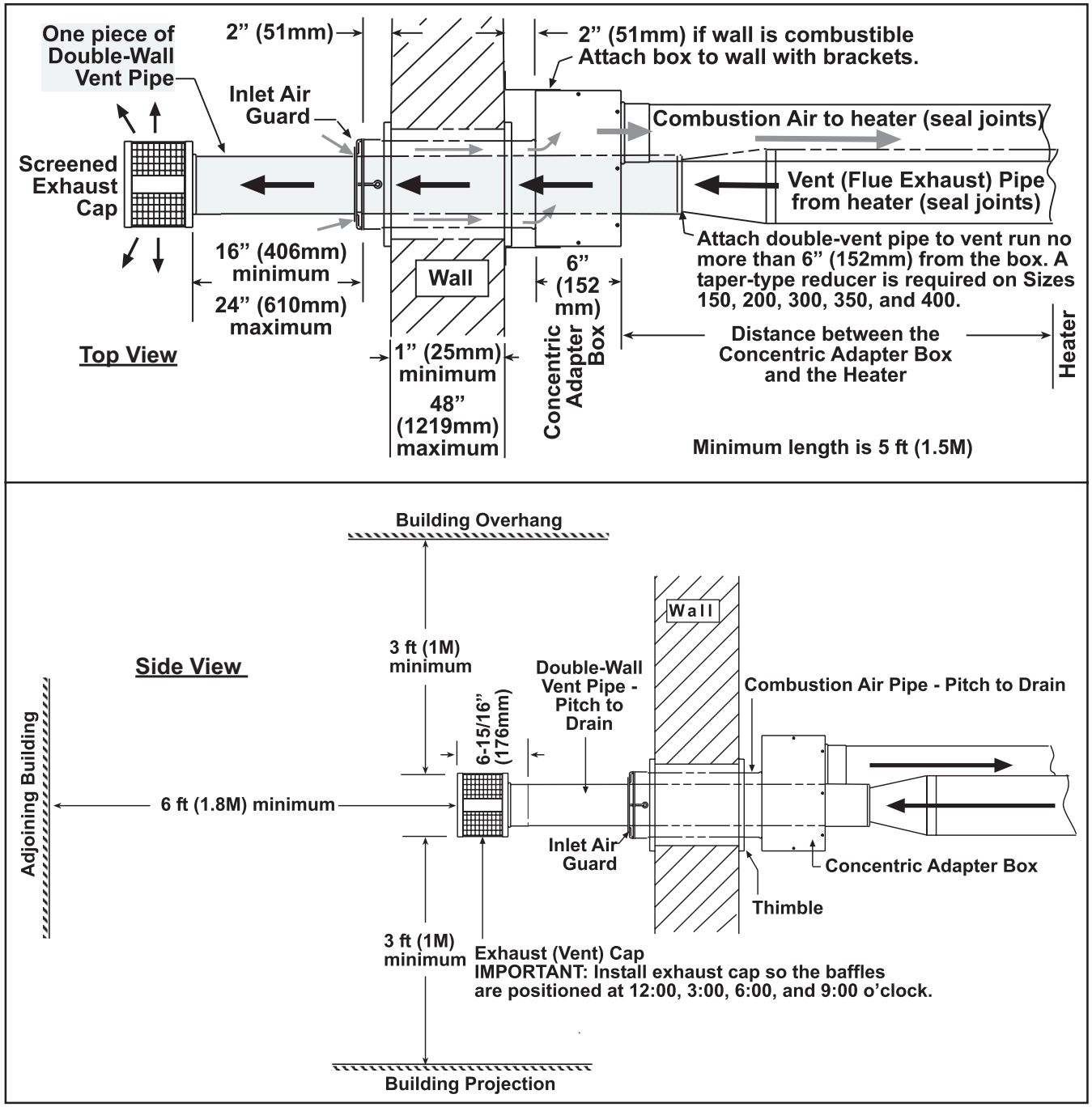


Figure 21. Option CC6 Installation

Venting/Combustion Air Connections—Continued

Horizontal Vent Terminal for Separated-Combustion Installations (Option CC6)—Continued

7. Install inlet guard:
   a. Position inlet guard over end of combustion air pipe in accordance with **Figure 21**.
   b. Secure air inlet guard to inlet air pipe using four 1/2-inch-long screws provided.

NOTE: If vent pipe is inserted from outside, the exhaust cap may be attached before the double-wall vent pipe is installed. If cap is attached first, ensure that the baffle strips are positioned correctly when attaching the vent terminal pipe to the vent run (refer to step 8d below).

8. Install double-wall terminal vent pipe:

NOTE: The length of the vent pipe is determined by the installation within maximum and minimum requirements. The vent pipe extending through the box and the inlet air pipe must be one piece of double-wall vent pipe without joints.

   a. Refer to **Figure 21** to determine lengths of each pipe segment and to calculate total length required. Transition to single-wall or Category III vent pipe run must be made maximum of 6 inches (152 mm) from heater side of box.
   b. Ensure that double-wall terminal vent pipe is in proper direction and slide end of pipe through box. Position pipe so that it will extend between 16–24 inches (406–610 mm) past end of combustion air pipe and no more than 6 inches (152 mm) out of box toward heater.

NOTE: The double-wall vent pipe does not attach to the box. The installer must provide support.

   c. Connect double-wall vent pipe to single-wall or Category III vent pipe run. For unit sizes 150, 200, 300, 350, and 400, a taper-type reducer is required (see **Figure 5**).
   d. Ensure that exhaust cap is aligned so that its baffle strips are positioned on horizontal and vertical center lines (see **Figure 21**). Install cap in accordance with **Figure 10**.
   e. Ensure that double-wall section of vent pipe has slight downward drop of 1/4-inch per foot (6 mm per 305 mm) toward vent terminal end.
   f. Seal completely around circumference of pipe and opening of box using silicone sealant.
9. Install indoor section of combustion air pipe:
   a. Secure single-wall combustion air pipe run to collar on concentric adapter box using sheet metal screws. For unit sizes 150 and 200, install tapered enlarger as shown in **Figure 12**.
   b. Seal pipe joints with tape or sealant.
10. Verify compliance with **Figure 21** and with all specific venting requirements listed above.

Piping Connections

Gas Supply Pressure

The unit is equipped for a maximum gas supply pressure of 1/2 psi, 3.5 kPa, or 14 IN WC.

NOTES:

Supply pressure higher than 1/2 psi requires the installation of an additional service regulator external to the unit.

PRESSURE TESTING SUPPLY PIPING

- **Test pressures *above* 1/2 psi—disconnect the heater and manual valve from the gas supply line to be tested. Cap or plug the supply line.**
- **Test pressures *below* 1/2 psi—before testing, close the manual valve on the heater.**

Gas Supply Piping

⚠ DANGER ⚠

- **All components of a gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME. Failure to comply could result in personal injury, property damage, or death.**
- **Pipe joint compounds (pipe dope) shall be resistant to the action of liquefied petroleum gas or any other chemical constituents of the gas being supplied.**

- All piping must be in accordance with requirements outlined in the *National Fuel Gas Code* ANSI/Z223.1 (latest edition) or the *Natural Gas and Propane Installation Code* CSA B149.1 (refer to **Installation Codes** section).
- Gas supply piping installation should conform with good practice and with local codes.
- The heater is orificed for operation with natural gas having a heating value of 1,000 (±50) BTU per cubic foot or with propane gas having a heating value of 2,550 (±100) BTU per cubic foot. Sizing of gas supply lines depends on piping capacity and is based on cubic feet per hour based on a 0.3 IN WC pressure drop, a 0.6 specific gravity for natural gas at 1,000 BTU per cubic feet, and a 1.6 specific gravity for propane at 2,550 BTU per cubic feet. If the gas at the installation does not meet this specification, consult the factory for proper orificing.
- Variables for sizing gas supply lines are listed in **Table 16**. When sizing supply lines, consider possibilities of future expansion and increased requirements. Refer to the *National Fuel Gas Code* for additional information on line sizing.

Table 16. Gas Supply Line Sizes

Length of Pipe (Feet)	Diameter of Pipe (Inches)											
	1/2		3/4		1		1-1/4		1-1/2		2	
	Natural Gas	Propane Gas	Natural Gas	Propane Gas	Natural Gas	Propane Gas	Natural Gas	Propane Gas	Natural Gas	Propane Gas	Natural Gas	Propane Gas
	Cubic Feet per Hour											
20	92	56	190	116	350	214	730	445	1100	671	2100	1281
30	73	45	152	93	285	174	590	360	890	543	1650	1007
40	63	38	130	79	245	149	500	305	760	464	1450	885
50	56	34	115	70	215	131	440	268	670	409	1270	775
60	50	31	105	64	195	119	400	244	610	372	1105	674
70	46	28	96	59	180	110	370	226	560	342	1050	641
80	43	26	90	55	170	104	350	214	530	323	990	604
90	40	24	84	51	160	98	320	195	490	299	930	567
100	38	23	79	48	150	92	305	186	460	281	870	531
125	34	21	72	44	130	79	275	168	410	250	780	476
150	31	19	64	39	120	73	250	153	380	232	710	433
175	28	17	59	36	110	67	225	137	350	214	650	397
200	26	16	55	34	100	61	210	128	320	195	610	372

Supply Piping Connections

- Gas connections sizes are listed in **Table 17**.
- Install a ground joint union and manual shutoff valve upstream of the unit control system. The 1/8-inch plugged tapping in the shutoff valve provides connection for the supply line pressure test gauge. The *National Fuel Gas Code* requires the installation of a trap with a minimum 3-inch drip leg. Local codes may require a longer drip leg, typically 6-inch (see **Figure 22**).
- Seal the opening for the gas supply pipe with the grommet provided.
- Bleed the system of all air and leak test all connections by brushing on a soap solution.

Piping Connections—Continued

Supply Piping Connections—Continued

Table 17. Gas Connection Sizes		
Gas Type	Unit Size	
	150, 200	250–400
	Connection Size (Inches)	
Natural gas	1/2	3/4
Propane		
NOTE: The above are not supply line sizes. They are gas connection sizes for a standard unit.		

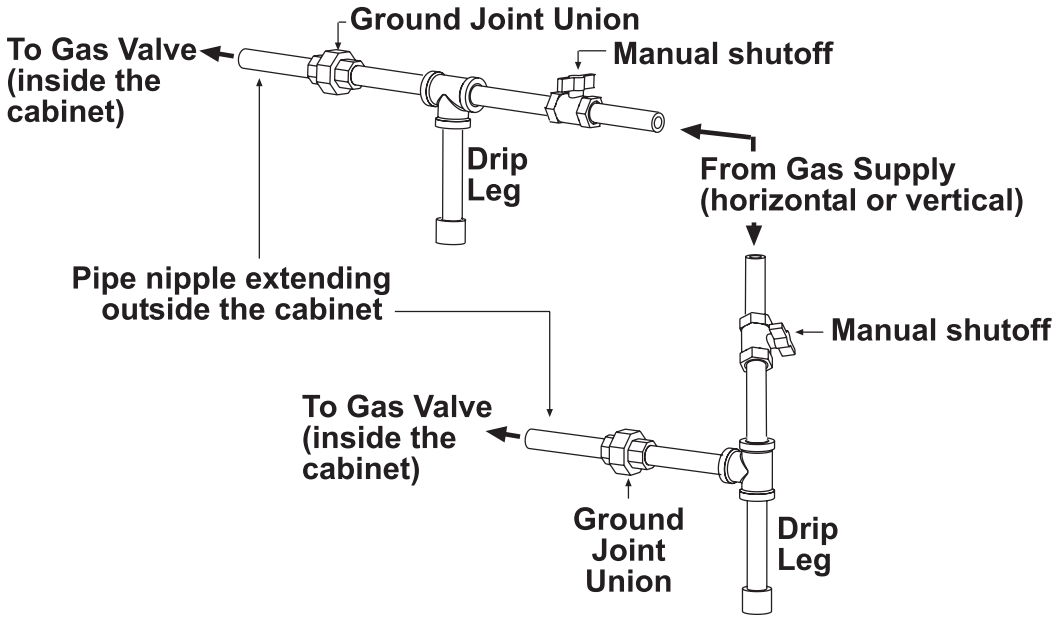


Figure 22. Gas Connections

Condensate Drain Installation

- **Burner condensate drain:** If the packaged unit includes a cased cooling coil, the installation of a burner condensate drain line is required. The parts to install the drain line are packaged and shipped with all Model CAUA heaters. Refer to the installation instructions provided with the burner condensate drain kit (PN 165951).
- **Cased cooling coil condensate drain:** If the packaged unit includes a cased cooling coil, the installation of a cased cooling coil condensate drain line is required. Refer to the installation instructions provided with the cased cooling coil.
- **Flue wrapper condensate drain:** If equipped with a makeup air option to allow inlet air less than 35°F (option AD4), the flue wrapper will have a condensate drain (see **Figure 23**). The condensate drain tubing exits through an opening in the side panel. Connect it into either the burner or coil drain or directly into a sanitary drain.

NOTE: Periodic cleaning of the condensate collector and disposal system is required.

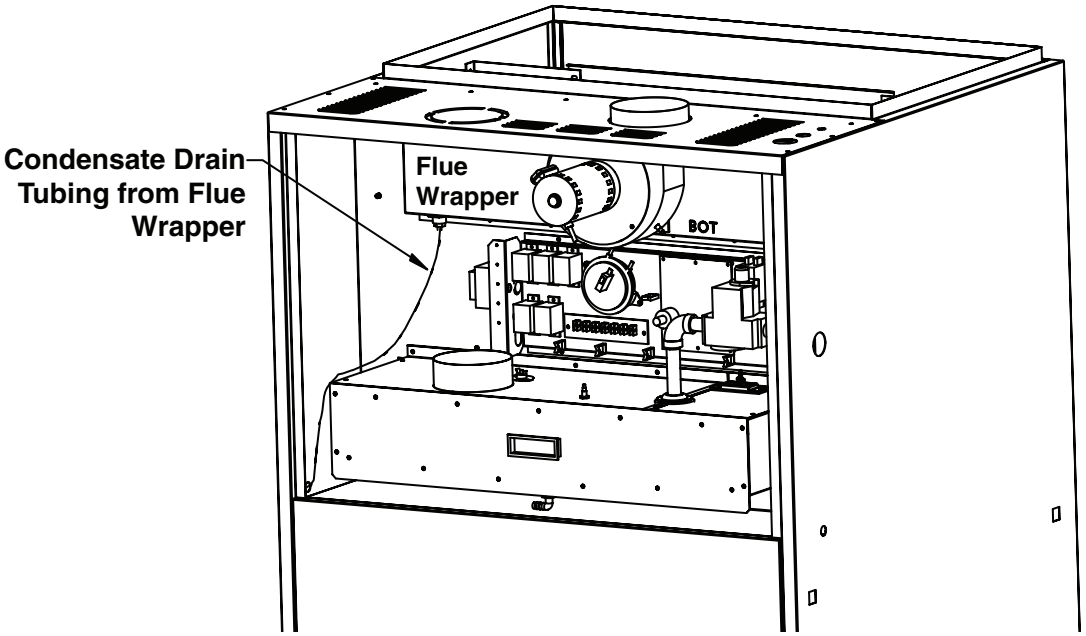


Figure 23. Flue Wrapper Condensate Drain

Electrical Connections

⚠ WARNING ⚠

If you turn OFF the power supply, turn OFF the gas.

⚠ CAUTION ⚠

- **If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C, except for the sensor lead wires, which must be rated at 150°C.**
- **All external wiring must be within approved conduit and have a minimum temperature rise rating of 60°C. Conduit from the disconnect switch must be run so as not to interfere with the service panels of the heater.**

NOTES:

- **Ensure that all wiring is in accordance with the wiring diagram provided with the unit.**
- **Refer to separate instruction sheets for any optional equipment provided.**

- All electrical wiring and connections, including electrical grounding, MUST be completed in accordance with local, state and national codes and regulations and with the *National Electric Code* (ANSI/NFPA No. 70) or in Canada, the *Canadian Electrical Code* Part 1 (CSA C.22.1). In addition, the installer should be aware of and comply with any local ordinances or gas company requirements.
- Check the rating plate on the heater for the supply voltage and current requirements.
- A separate line voltage supply with fused disconnect switch should be run directly from the main electrical panel to the heater.

Electrical Supply and Control Wiring

The electrical supply and control wiring enter at the top of the heater (see **Figure 1**) and connect to the supply voltage terminal strip located above the contactor(s) or starter(s). Consult the wiring diagram provided with the heater.

Electrical Connections—Continued

Thermostat Wiring

- Control wiring enters on the right side of the heater and connects to the terminal strip in the control compartment (see **Figure 24**).
- For cooling unit connections, refer to the wiring diagram or the cased cooling coil installation instructions. Follow the thermostat manufacturer's instructions.

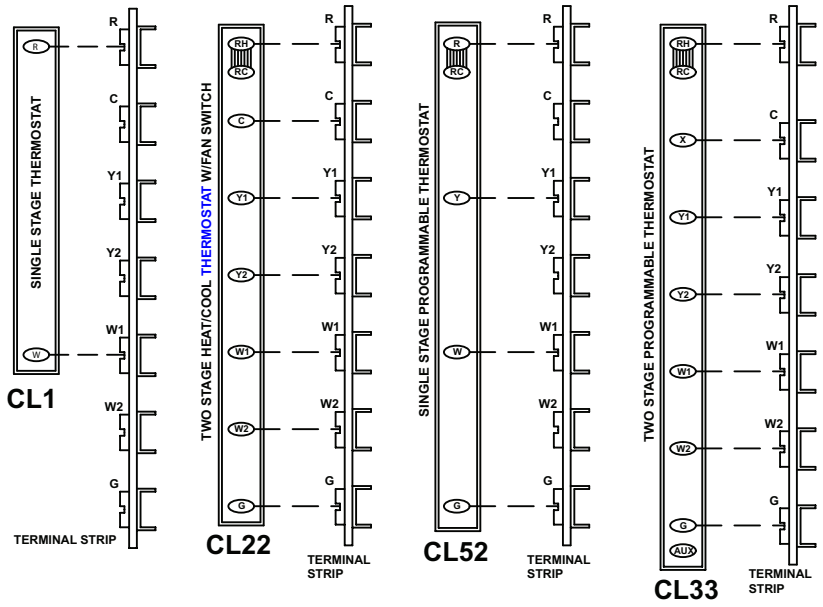


Figure 24. Wiring Connections for Options CL1, CL22, CL52, and CL33

CONTROLS

NOTE: Refer to the TROUBLESHOOTING section for probable causes and reset instructions for the following controls.

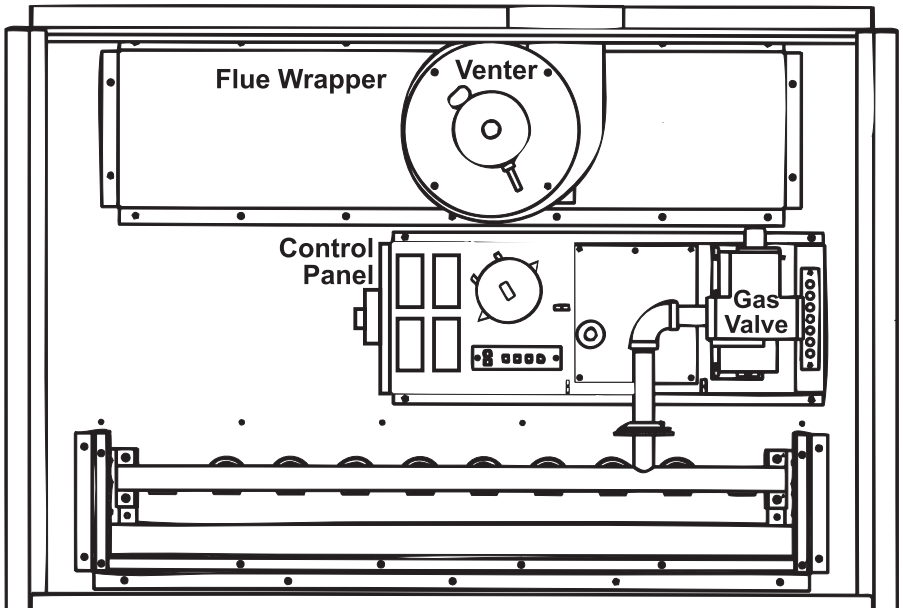


Figure 25. Control Locations

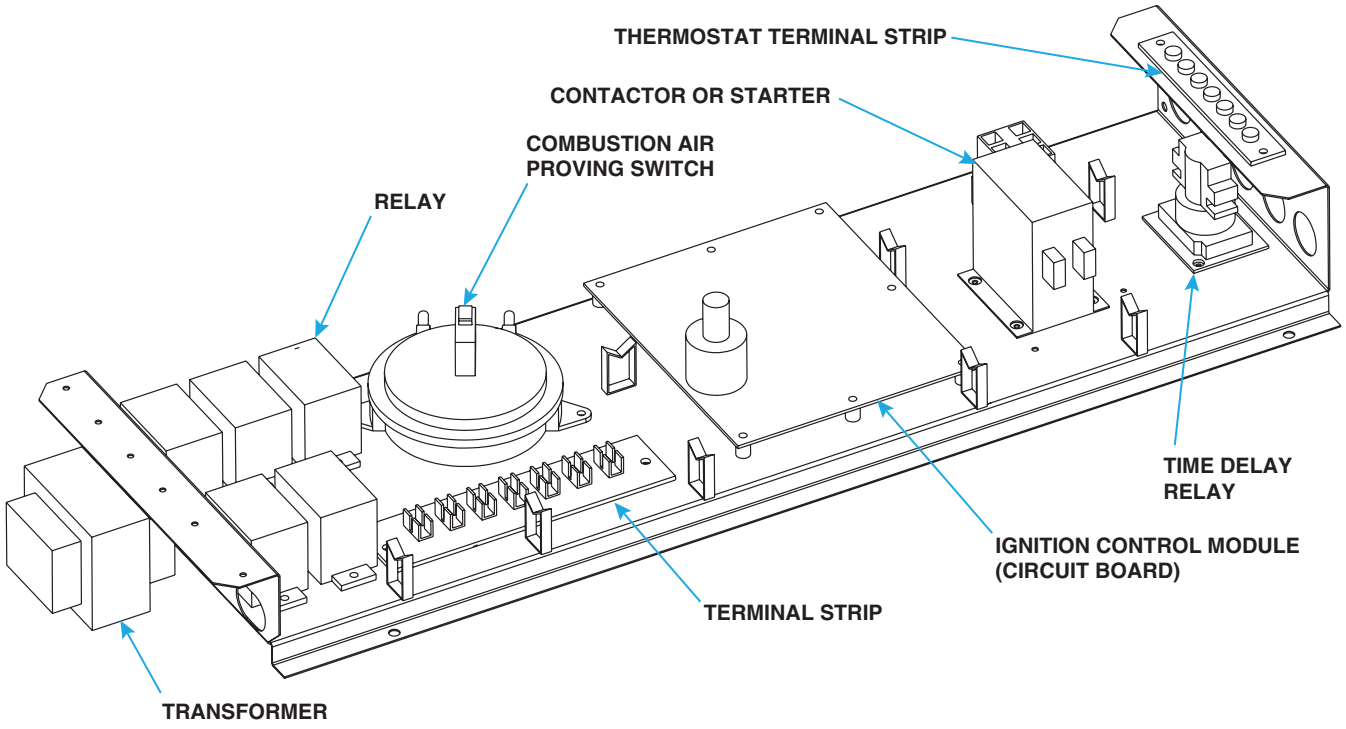


Figure 26. Control Panel

Thermostat

- A thermostat is not standard equipment but is an installation requirement. Use either an optional thermostat available with the heater or a field-supplied 24V thermostat. Install according to the thermostat manufacturer's instructions.
- Ensure that the heat anticipator setting on the thermostat is in accordance with the amperage value listed on the wiring diagram of the heater.

Combustion Air Proving Switch

⚠ DANGER ⚠

Safe operation requires proper venting flow. Never bypass the combustion air proving switch or attempt to operate the unit without the venter running and proper flow in the vent system. Hazardous conditions could result.

- The combustion air proving switch is a pressure-sensitive switch that monitors air pressure to ensure that proper combustion air is available. The switch is single pole/double throw with the normally open contacts closing when proper airflow is sensed in the system.
- At startup when the furnace is cold, the sensing pressure is at the most negative level. As the furnace and the flue system warm up, the sensing pressure becomes less negative. After the system has reached equilibrium (approximately 20 minutes), the sensing pressure levels off. If a restriction or if excessive flue length or turns cause the sensing pressure to become less than the switch setpoint, the pressure switch will function to shut off the main burners. The main burners will remain off until the system has cooled and/or the flue system resistance is reduced. Refer to **Table 18** for approximate water column negative pressure readings and combustion air proving switch setpoints for sea level operating conditions (standard settings apply to 0–4000 feet elevation (US) or 0–2000 feet elevation (Canada)).

Combustion Air Proving Switch—Continued

Table 18. Combustion Air Proving Switch Settings

Unit Size	Startup Cold	Equilibrium	Setpoint OFF	Setpoint ON
	IN WC			
150	1.45	1.05	0.75	0.90
200	1.50	1.05		
250	1.55	1.10		
300	1.60	1.15		
350	1.30	1.05		
400	1.20	1.00		

Flame Rollout Switch

The flame rollout switch is a temperature-activated manually reset, limit switch. The switch is mounted on the side of the burner box in a position that senses temperature in a central horizontal location at the rear of the burner assembly. If the flame rollout switch activates to shutdown the heater, the cause must be corrected.

Limit Control

The limit control is a temperature-sensitive safety device that shuts down the gas valve if a temperature above the setpoint is sensed. The limit control is an automatic-reset type with a capillary sensor. When the temperature drops below the setpoint, the limit control deactivates to allow operation of the heater. The capillary sensor extends across the heat exchanger section of the unit to sense the temperature of the discharge air.

Combination Gas Valve

⚠ WARNING ⚠

The combination gas valve is the prime safety shutoff. To ensure positive closure, all gas supply lines must be free of dirt or scale before connecting them to the unit.

The combination gas valve automatically controls the gas flow to the main burners and regulates the gas pressure. The gas valve is powered by the 24V control circuit through the thermostat and safety controls. The diaphragm-type valve provides regulated gas flow pre-set at the factory.

Venter Assembly

The venter assembly provides a metered flow of combustion air to the burner and exhausts the products of combustion to the outside atmosphere.

Ignition System

- A model CAUA heater is equipped with a direct-spark integrated-control system. The system monitors the safety devices and controls the operation of the blower and venter motors and the gas valve.
- **Ignition control module:** The ignition control module is an integrated board located in the control compartment. Supply and control wiring connects into the control module. The module's LEDs identify operating problems. The control module also acts as a fan control energizing the fan 30 seconds after ignition and delaying fan shutdown for 160 seconds after the gas valve closes. This control is on units manufactured ***after*** FEB 2009. To replace an ignition control module on a unit manufactured ***before*** MAR 2009, order kit PN 258251. Refer to **Table 19** for fan delay DIP switch settings.
- **Ignitor:** The ignitor is located on the right side of the burner assembly. The 1/8-inch spark gap must be maintained.
- **Flame sensor:** The flame sensor is located on the left side of the burner assembly.

Table 19. Fan Delay DIP Switch Settings		
DIP Switch		Fan Delay to OFF (Seconds)
SW1	SW2	
ON/OFF*		
OFF	OFF	120
OFF	ON	90
ON	OFF	160 (factory-set)
ON	ON	45
*Selected prior to call for heat.		

Dirty Filter Switch

If there is a remote console (option RC) and there is a dirty filter indicator light on the console, there is a dirty filter switch either in the optional mixing box or in the main electrical compartment. After the unit is started, before continuous operation, the dirty filter switch must be set (refer to **Dirty Filter Switch Adjustment** section).

Transformer

The 40VA transformer reduces the supply voltage to a 24V circuit in order to operate the 24V controls.

Belts, Blowers, and Drives

- Model CAUA units are equipped with either direct-drive motor(s) and blower(s) or adjustable belt-drive blower(s) and motor. All direct-drive blower motors are 1 Horsepower (HP). Unit sizes 150–200 have a single motor, unit size 150 has a 12-9 blower, and unit size 200 has a 12-12 blower. Unit sizes 250–400 have dual motors with dual 12-9 blowers. The motor HP on a belt-drive unit is whatever was specified on the order ranging in size from 1/3- to 5-HP. Check the heater rating plate and the motor rating plate.
- The blower motor and blower are located in the blower compartment at the bottom of the heater. The blower compartment door is equipped with a safety switch. If the door is not closed, the heater will not operate.
- The function of the motor and drive is to provide airflow through the heat exchanger and supply air to the space.

Belt Drive with Optional Variable Frequency Drive

When an optional variable frequency drive is ordered, the motor operates on two speeds as determined by the electrical frequency. High speed is used for cooling and low speed for heating. 60Hz is the maximum high speed. Maximum speed for low speed heating is the frequency that will provide the maximum temperature rise of the heater. The allowable temperature rise range is 45–75°F.

Blower Compartment Door Switch

The blower compartment door is equipped with a safety switch. If the door is not closed securely, the heater will not operate.

Ductstat (Two-Stage, Makeup Air, Option AG3)

NOTE: This option is available only when the heater is equipped with makeup air option AD4.

- Two-stage makeup air units are equipped with a two-stage gas valve, but instead of control from a two-stage room thermostat, the outlet air temperature is monitored and controlled by a two-stage ductstat.
- The ductstat with attached capillary tube senses the discharge air temperature and operates the two stage valve to maintain the temperature within a fixed differential of 2-1/2°F. Adjustable factory setting is 70°F.
- The ductstat is factory-mounted in the control compartment of the heater and has a capillary that must be field-installed. To complete the installation, uncoil the tubing, extend the capillary, and mount it in the ductwork. Follow the instructions provided by the ductstat manufacturer.

CONTROLS—CONTINUED

Inlet Air Dampers

Dampers and controls are located in the optional outside air/return air mixing box (potentiometer may be remotely located). Dampers operate in response to controls.

Two-Position Damper Motor

The two-position damper motor opens and closes the dampers. Damper position is either on when the unit is operating or is determined by a two-position enthalpy control.

Modulating Damper Motor

The modulating damper motor actuates the dampers in response to a potentiometer or a mixed air controller. Outside air dampers close when the heater shuts down.

Modulating Damper Motor with Logic Module

The modulating damper motor actuates the dampers in response to enthalpy controls for cooling or a mixed air controller for heating. Outside air dampers close when the heater shuts down.

Potentiometer

The potentiometer is a manually set switch used with modulating dampers to set a minimum outside air damper opening. It is either mounted in the mixing box or remotely located.

Return Air Controller

The return air controller senses the temperature of the incoming return air. On a two-position outside air damper system, it activates the motor to open and close the outside air damper. On a modulating system, the return air controller maintains 100% return air until the set temperature is reached at which point the mixed air controller (with or without potentiometer) controls the dampers based on the mixed air control setting. When in the heating mode, the temperature of the mixed return and outside air entering a standard model CAUA heater must always be 35°F or above. Only when the heater is factory-equipped with makeup air option AD4 can the entering air temperature be below 35°F.

Mixed Air Controller

The mixed air controller senses the temperature of the air entering the heater. It automatically operates the damper motor to modulate the outside and return air dampers based on the temperature setting. When in the heating mode, the temperature of the mixed return and outside air entering a standard model CAUA heater must always be 35°F or above. Only when the heater is factory-equipped with makeup air option AD4 can the entering air temperature be below 35°F.

Enthalpy Sensor for Two-Position Control

The enthalpy control senses the enthalpy (heat content in 1 pound of air) of the outside air entering the heater. When the enthalpy is low, the control activates the motor to open the outside air damper; when high, it closes the outside air damper.

Enthalpy Sensors for Modulating Control

There are two enthalpy sensors, one for outside air and one for return air. Input from the two enthalpy sensors and the thermistor sensor to the logic module on the motor allow the motor to modulate the dampers to maintain the set temperature and control the moisture of the air entering the heater.

OPERATION

Pre-Startup Checklist

⚠ CAUTION ⚠

IMPORTANT: Before applying power, check the blower pulley, blower wheel, and motor pulley to ensure that they are secure to the shaft. Check blower and pulleys for free movement.

- ❑ Verify clearances from combustibles (refer to **Clearances** section).
- ❑ If unit is installed as separated-combustion unit, verify that vent/combustion air system is installed in accordance with **Venting/Combustion Air Connections** section.
- ❑ Check piping for leaks and proper gas line pressure. Bleed gas lines of trapped air (refer to **Supply Piping Connections** section).
- ❑ Check blower compartment to ensure that all shipping supports have been removed.
- ❑ Check belt tension and alignment.
- ❑ Securely close blower compartment door—heater will not operate if blower compartment door is not closed.
- ❑ Check electrical wiring—ensure that all wire gauges are as recommended.
- ❑ A service disconnect switch should be used.
- ❑ Verify that fusing or circuit breakers are adequate for load use.
- ❑ If unit is equipped with mixing box with both return and outside air dampers, verify that damper linkage has been adjusted (refer to mixing box installation manual listed in **Table 1**).
- ❑ If unit is equipped with condensate drain (either cooling coil, flue wrapper, and/or burner), verify that condensate lines are connected and that drain traps are filled with clean water.
- ❑ If unit is equipped with cooling coil, verify that thermostatic expansion valves are installed properly (refer to cooling coil installation manual listed in **Table 1**).
- ❑ Ensure that refrigerant circuits are charged with appropriate refrigerant and are leak-tested. Follow the instructions with the MASA condenser or other matching condenser.

Startup

⚠ DANGER ⚠

- **For your safety, read before operating. If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.**
- **This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.**
- **Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.**
- **If you smell gas:**
  - **a. Open windows.**
  - **b. Don't touch electrical switches.**
  - **c. Extinguish any open flame.**
  - **d. Immediately call your gas supplier.**
- **Use only your hand to turn the gas control ON/OFF knob on the gas valve. Never use tools. If the valve ON/OFF knob will not turn by hand, do not try to repair it. Call a qualified service technician. Force or attempted repair may result in a fire or explosion.**
- **Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.**

Startup—Continued

1. Set thermostat to lowest setting.
2. Turn OFF all electric power to appliance.
3. Appliance is equipped with ignition device that automatically lights burner—do not try to light burner by hand—open access door and locate gas valve.
4. See **Figure 27**. For unit sizes 150 and 200, locate gas control (ON/OFF) knob on gas valve and turn gas control knob clockwise to OFF. For unit sizes 250, 300, 350, and 400, locate gas control (ON/OFF) knob on gas valve and turn knob clockwise so that line on knob aligns with position indicator. Depress knob and continue rotation to OFF position.

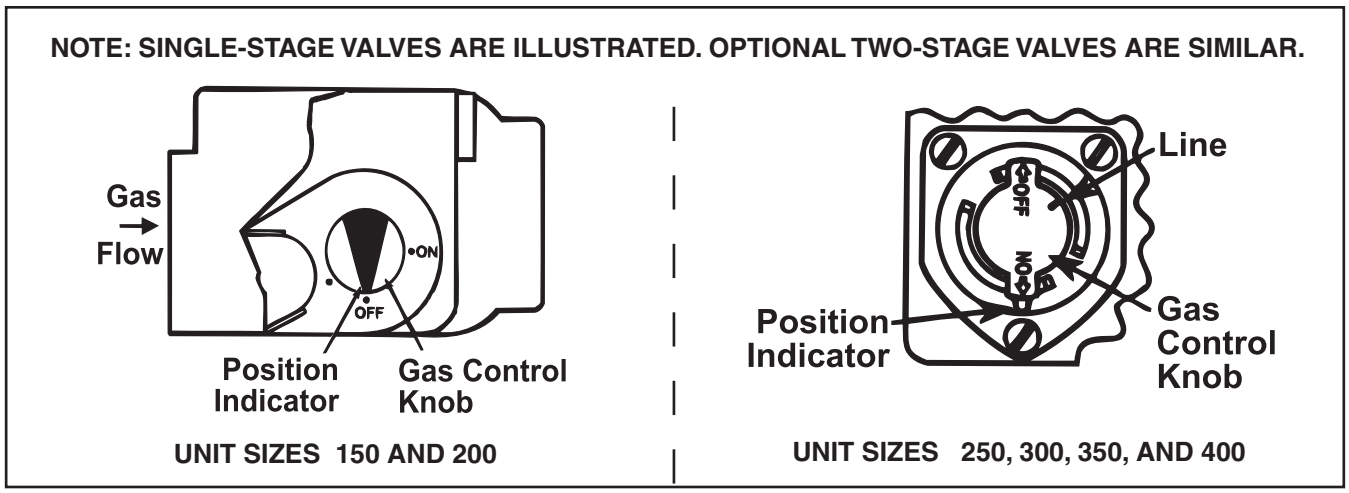


Figure 27. Typical Gas Control Knob

5. Wait 5 minutes to clear out any gas and then smell for gas, including near floor. If you smell gas, STOP! and follow above DANGER statement or WARNINGS or on operating label on heater. If you do not smell gas, proceed to next step.
6. See **Figure 27**. For unit sizes 150 and 200, turn gas control knob counterclockwise to ON. For unit sizes 250, 300, 350, and 400, turn knob counterclockwise so that line on knob aligns with position indicator. Allow knob to pop up and continue rotation to ON position.
7. Close access door.
8. Turn ON electric power to heater.
9. Set thermostat to desired setting.

NOTE: If the appliance does not operate, follow the instructions in step 14 (and on the operating label on the heater). Call your service technician.

10. Thermostat calls for heat and energizes venter motor.
11. Venter pressure switch closes and allows unit to fire.
12. Burner flame is sensed and in 30 seconds, blower motor is energized.
13. If flame is extinguished during main burner operation, integrated control system closes main valve and must be reset by interrupting power to control circuit. Refer to lighting instructions on heater.
14. TO TURN OFF GAS TO THE APPLIANCE:
    a. Set thermostat to lowest setting
    b. If service is to be performed, turn OFF electric power to appliance.
    c. Open access door.
    d. Turn gas control knob to OFF (refer to step 4). Do not force control knob.
    e. Close access door.

Operating Sequences

Normal Heat Cycle Operating Sequence

- **Call for heat:** The heating/cooling system controller calls for heat. The ignition system circuit board checks to see that the limit switch is closed and the pressure switch is open. If the limit switch is open, the circuit board responds as defined in the **Abnormal Heat Cycle Functions**, ***Limit switch operation*** section. If the pressure switch is closed, the circuit board will do four flashes on the green LED and wait indefinitely for the pressure switch to open. If the pressure switch is open, the circuit board proceeds to prepurge.
- **Prepurge:** The circuit board energizes the venter motor and waits for the pressure switch to close. If the pressure switch does not close within 30 seconds of the venter motor energizing, the circuit board will do two flashes on the green LED. The circuit board will leave the venter motor energized indefinitely as long as the call for heat remains and the pressure switch is open. When the pressure switch is proven closed, the circuit board begins the prepurge time. If flame is present any time while in prepurge, the prepurge time is restarted. If flame is present long enough to cause lockout, the circuit board responds as defined in the **Ignition System Fault Modes**, ***Undesired flame*** section. The ignition system circuit board runs the venter motor for a 20 second prepurge time, then proceeds to the ignition trial period.
- **Ignition trial period:** The ignition system circuit board energizes the spark and main gas valve. The venter remains energized. If flame is sensed during the first 16 seconds, the spark is de-energized. If flame has not been sensed during the first 16 seconds, the control de-energizes the spark output and keeps the gas valve energized for an additional one second flame proving period. If flame is not present after the flame proving period, the control de-energizes the gas valve and proceeds with ignition re-tries as specified in the **Abnormal Heat Cycle Functions**, ***Ignition retry*** section. If flame is present, the circuit board proceeds to steady heat.
- **Steady heat:** Circuit board inputs are continuously monitored to ensure limit and pressure switches are closed, flame is established (sensor on both burner sections), and the system controller call for heat remains. When the call for heat is removed, the ignition system circuit board de-energizes the gas valve and begins postpurge timing.
- **Post-purge:** The venter motor output remains on for a 45 second postpurge period after the system controller is satisfied.

Abnormal Heat Cycle Functions

- **Interrupted call for heat:** If the system controller call for heat is removed before the flame is recognized, the circuit board will run the venter motor for the post purge period and de-energize all outputs. If the call for heat is removed after successful ignition, the circuit board will de-energize the gas valve and run the venter motor through post purge.
- **Ignition retry:** If flame is not established on the first trial for ignition period, the ignition system circuit board de-energizes the gas valve, and the venter motor remains energized for an inter-purge period of 10 seconds. The spark and gas valve are then re-energized, and the circuit board initiates another trial for ignition. If flame is not established on the second trial for ignition, the circuit board de-energizes the gas valve and venter motor remains energized. The spark and gas valve are re-energized and the circuit board initiates another trial for ignition. If flame is not established on the third trial for ignition period, the circuit board de-energizes the gas valve, and the venter motor remains energized for an inter-purge period of 10 seconds. The circuit board then re-energizes the gas valve and spark and initiates another trial for ignition. If flame is not established on the fourth trial for ignition (initial try plus three re-tries), the circuit board de-energizes the gas valve and goes into lockout. The circuit board goes to one flash on the green LED to indicate ignition failure lockout.
- **Limit switch operation:** The limit switch is ignored unless a call for heat is present (W energized). If the limit switch is open and a call for heat is present, the control de-energizes the gas valve, runs the blower motor on heat speed, and runs the induced draft (venter) motor. The control will be in soft lockout and flashing fault code “3”, before returning to normal operation. When the limit switch re-closes or the call for heat is lost, the control runs the induced draft motor through post purge and runs the blower through the selected fan off delay.

Operating Sequences—Continued

Abnormal Heat Cycle Functions—Continued

- **Pressure switch:** If the pressure switch opens before the trial for ignition period, the venter motor will run through the pressure switch recognition delay (2 seconds), the gas valve will be de-energized, and the venter motor will run through the postpurge time. The ignition system circuit board will re-start the heat cycle at the pressure switch proving state if the call for heat still exists. Pressure switch opening for less than 2 seconds during the trial for ignition period shall not interrupt the heat cycle (gas valve will de-energize while the pressure switch is open). If the pressure switch opens after a successful ignition, the circuit board will de-energize the gas valve. If flame is lost before the end of the 2-second pressure switch recognition delay, the circuit board will respond to the loss of flame. If the pressure switch remains open for 2 seconds and the flame remains, the circuit board de-energizes the gas valve and the venter motor runs through postpurge. Power interruptions of less than 80 mS shall not cause the circuit board to change operating states. Power interruptions greater than 80 mS may cause the circuit board to interrupt the current operating cycle and restart.

Ignition System Operating Sequence

NOTE: This is a three trial system. The unit will lockout for one hour before initiating another trial for ignition. If the unit fails after one recycle interval, the unit will go into hard lockout and must be reset by interrupting power or resetting the thermostat. To initiate another trial for ignition before the one hour interval, either reset the thermostat or interrupt power to the unit for 30 seconds.

- **Call for heat from thermostat:** On a call for heat from the thermostat, the system energizes the venter motor and goes through a 10-second prepurge. The system verifies that the pressure switch has changed states closing the normally-open contactor and that the high limit is in the closed state.
- **Gas valve is energized:** The gas valve is then energized, and the ignition system provides the high-voltage spark to the electrode to ignite the main burner gas.
- **Carryover of all burners:** Burner flame is electronically sensed by the control (minimum 1.0 microamps) upon carryover of all burners. A separate solid metal probe is used as the flame sensing function. A low-voltage electrical signal is imposed on the metal probe which is electrically isolated from ground.
- **Flame impinges on flame-sensing probe:** When the flame impinges on the flame sensing probe, the flame acts as a conduction path to ground. The flame rectifies and completes the DC circuit, and the ignition system acknowledges the flame. The blower motor is energized by the system after 30 seconds of flame sensing.
- **Thermostat is satisfied:** After the thermostat has been satisfied, the system de-energizes the gas valve, the venter motor goes through a 45-second post-purge, and the blower motor remains energized for an additional 135 seconds.

Ignition System Fault Modes

- **Undesired flame:** If flame is sensed longer than 20 seconds while the gas valve is de-energized, the circuit board shall energize the venter motor. When flame is no longer sensed, the venter motor will run through postpurge. The circuit board will do a soft lockout, but will still respond to open limit and flame. The FLAME (yellow) LED shall flash rapidly when lockout is due to undesired flame.
- **Gas valve relay fault:** If the circuit board senses the gas valve as energized for more than one second when the circuit board is not attempting to energize the gas valve, or the gas valve is sensed as not energized when it is supposed to be energized, then the circuit board will lockout with the green LED off. The control assumes either the contacts of the relay driving the gas valve have welded shut, or the sensing circuit has failed. The venter motor is forced off to open the pressure switch to stop gas flow unless flame is present. If the gas valve was sensed as closed when it should be open, and has not de-energized after the venter motor was shutoff for 15 seconds, then the venter motor is re-energized to vent the unburned gas.

- **Soft lockout:** The circuit board shall not initiate a call for heat while in lockout. The circuit board will still respond to an open limit and undesired flame. Lockout shall automatically reset after one hour. Lockout may be manually reset by removing power from the circuit board for more than one second or removing the call for heat for more than one and less than 20 seconds.
- **Hard lockout:** If the circuit board detects a fault on the board, the status LED will be de-energized, and the circuit board will lockout as long as the fault remains. A hard lockout will automatically reset if the hardware fault clears.
- **Power interruption:** During a momentary power interruption or at voltage levels below the minimum operating voltage (line voltage or low voltage) the ignition system will self-recover without lockout when voltage returns to the operating range. Power interruptions of less than 80 mS shall not cause the circuit board to change operating states. Power interruptions greater than 80 mS may cause the circuit board to interrupt the current operating cycle and restart.

Vent System Testing

For power-vent units (does not apply to separated-combustion installation option CC2 or CC6), test the vent system as follows:

1. Seal any unused openings in venting system.
2. Inspect venting system for proper size and horizontal pitch, as required in National Fuel Gas Code, ANSI Z223.1 or CAN/CSA B149.1 and B149.2, *Installation Code for Gas Burning Appliances and Equipment*, and in this manual.
3. Determine that there is no blockage or restriction, leakage, corrosion, or other deficiencies that could cause unsafe conditions.
4. In so far as practical, close all building doors and windows and all doors between heater space and other building spaces.
5. Turn on clothes dryers and exhaust fans, such as range hoods and bathroom exhausts, so they operate at maximum speed. Do not operate summer exhaust fan. Close fireplace dampers.
6. Light heater following lighting instructions, adjust thermostat for continued operation, and verify that combustion products are venting properly.
7. After determining that heater vents properly, return doors, windows, exhaust fans, and fireplace dampers to their previous conditions. If improper venting is observed, venting system must be corrected.

Post-Startup Checklist

- ❑ With unit in operation, measure manifold gas pressure. Manifold pressure for natural gas should be 3.5 IN WC and 10 IN WC for propane (refer to **Measure and Adjust Manifold (Outlet) Gas Pressure** section).
- ❑ Turn unit OFF and ON, pausing 2 minutes between each cycle. Observe for smooth ignition.
- ❑ If equipped with dirty filter switch, set switch (refer to **Dirty Filter Switch Adjustment** section).
- ❑ Place owner's envelope that contains limited warranty, this manual, and any control or optional information in accessible location near heater. Follow instructions on envelope.
- ❑ IMPORTANT: After at least 8 hours but no longer than 1 week of operation, recheck blower wheel, all setscrews, blower pulley, motor pulley, and belt tension. Make any required adjustments.

Post-Startup Checklist—Continued

⚠ DANGER ⚠

- **The gas burner in this gas-fired equipment is designed and equipped to provide safe, complete combustion. However, if the installation does not permit the burner to receive the proper supply of combustion air, complete combustion may not occur. The result is incomplete combustion which produces carbon monoxide, a poisonous gas that can cause death. Safe operation of indirect-fired gas burning equipment requires a properly operating vent system which vents all flue products to the outside atmosphere. FAILURE TO PROVIDE PROPER VENTING WILL RESULT IN A HEALTH HAZARD WHICH COULD CAUSE SERIOUS PERSONAL INJURY OR DEATH.**
- **If installed as a separated-combustion unit, install either the horizontal or vertical combustion air/vent system (refer to Venting/Combustion Air Requirements for Separated-Combustion Installations section) using the concentric adapter supplied. Always comply with the combustion air requirements in the installation codes and instructions. Combustion air at the burner should be regulated only by manufacturer-provided equipment. NEVER RESTRICT OR OTHERWISE ALTER THE SUPPLY OF COMBUSTION AIR TO ANY HEATER. CHECK THE VENT SYSTEM FOR SOUNDNESS AND FUNCTION; MAINTAIN IT IN PROPER OPERATING CONDITION.**

ADJUSTMENTS

Checking and Adjusting Belt Tension

- Proper belt tension is important to the long life of the belt and motor. A loose belt will cause wear and slippage. Too much tension will cause excessive motor and blower bearing wear. Check belt tension as shown in **Figure 28**.
- If the belt cannot be depressed 3/4 inches (19 mm), as shown in **Figure 28**, adjust the belt tension as follows:
  a. Ensure that belt is aligned in pulley grooves properly and is not angled from pulley to pulley.
  b. Loosen adjusting screw locknut on motor base and turn adjusting screw until belt can be depressed 3/4 inches (19 mm).
  c. When correct belt tension is achieved, retighten adjusting screw locknut.

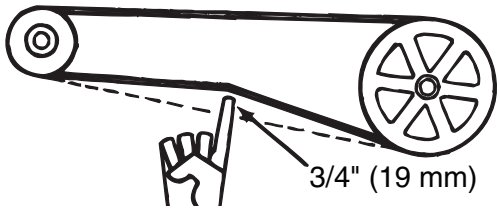


Figure 28. Checking Belt Tension

Adjusting Blower Speed

NOTE: Most blower motors are equipped with thermal overload protection of the automatic, reset type. If the motor is not equipped with thermal overload protection, the unit will be equipped with a starter. The adjustable setting on the starter will be factory-set and sealed to match the amp draw of the motor. No change should be made to the starter setting unless the original motor is replaced. Starters are equipped with a manual reset. If an overload condition is experienced, the condition must be corrected and the starter must be manually-reset.

- Blower speed may be adjusted to achieve the desired outlet temperature as long as the adjustment is within the temperature rise and the static pressure limits shown on the heater rating plate. Direct-drive motors are factory-set at medium speed for heating and at high speed for optional cooling (if ordered). Belt-drive motors are factory-set between maximum and minimum blower speeds. Belt drives may also be ordered with an optional variable frequency drive that changes motor speed by changing the electrical frequency to the motor.
- If the duct resistance is low, the blower may deliver too high an air volume. If the resistance is very low, the blower may deliver excess air to overload the motor, causing the overload protector to activate. Reducing the blower speed will correct these conditions. If ductwork is added to an installation, it may be necessary to increase the blower speed.
- After the installation is complete including all ductwork, the amp draw of the motor should be checked with an amp meter to verify that the motor amp rating on the motor nameplate is not being exceeded. Amps may be adjusted downward by reducing the blower speed or by increasing the duct system static pressure. The temperature rise must be within the range specified on the unit rating plate.
- **Direct-drive motors:** Direct drive motors have multi-speed taps for speed adjustment. If your installation requires an adjustment of the blower speed, the motor may be rewired to an alternate tap as follows:
  a. Turn OFF the gas and electric power.
  b. Remove the blower door panel.
  c. Refer to the wiring diagram on the heater and **Table 20** to choose the wiring for the desired adjustment. Units are wired at high speed for cooling (if ordered) and medium speed for heating.
  d. Cut the crimped cap for the end of the wire that you intend to use and strip the insulation.
  e. Disconnect the factory-wired connection and rewire using the newly stripped wire.
  f. Put a wire nut on the end of the blower motor wire that was disconnected.
  g. Replace the heater door panel. Turn ON the gas and electric. Check for proper operation.

Table 20. Direct-Drive Motor Wiring

Speed	Unit Size	
	150–250, 350	300, 400
	Use These Two Wires:	
High	White and black	
Medium		

- **Belt-drive motors:** Belt drives have an adjustable pulley which permits adjustment of the blower speed. Adjust the blower speed of a belt drive motor as follows:

NOTE: These instructions apply only to a belt-drive motor not equipped with an optional variable frequency drive.

a. Turn OFF the gas and the electric power.
b. Loosen belt tension and remove the belt.
c. Loosen the setscrew on the side of the pulley away from the motor.
d. To increase the blower speed, turn the adjustable half of the pulley inward. To decrease the blower speed, turn the adjustable half of the pulley outward. One turn of the pulley will change the speed 8–10%.
e. Tighten the set screw on the flat portion of the pulley shaft.
f. Replace the belt and adjust the belt tension. Adjust tension by turning the adjusting screw on the motor base until the belt can be depressed 3/4 inch (see **Figure 28**). Re-tighten the lock nut on the adjusting screw. Ensure that the belts are aligned in the pulley grooves properly and are not angled from pulley to pulley.

Adjusting Blower Speed—Continued

g. Turn ON the gas and electric. Light the heater following the instructions on the lighting instruction plate.

h. Check the motor amps with an amp meter. The maximum motor amp rating on the motor nameplate must not be exceeded.

i. When service is complete, check for proper operation.

- **Belt-drive with optional variable frequency drive:** Follow the variable frequency controller manufacturer's instructions that are packaged with the heater (in the owner's envelope) to program the variable frequency drive settings.

Motor Amp Adjustment

⚠ CAUTION ⚠

An external duct system static pressure not within the limits shown on the rating plate, or improper motor pulley or belt adjustment, may overload the motor or cause the limit control to activate.

- Use an amp meter to check motor amps. **Table 21** lists full load amps for all HP's and voltages. Amps may be adjusted downward by reducing blower RPM or increasing duct system static pressure.
- The amps listed in **Table 21** can be used for sizing line wiring but should not be interpreted as the exact motor amps. Refer to the motor rating plate for exact motor specifications. At final adjustment, amperes should not exceed motor nameplate amp rating. The installation must be adjusted to obtain a temperature rise within the range specified on the heater rating plate.

Table 21. FLA of Blower Motors

Voltage/Phase	HP							
	1/3	1/2	3/4	1	1-1/2	2	3	5
	FLA							
Direct-Drive Motors								
208/230V/1PH	—	—	—	6.3	—	—	—	—
Optional Belt-Drive OPEN Motors								
208V/1PH	3.0	5.1	5.5	7.5	7.8	12.3	13.7	28.0
230V/1PH	3.0	4.4	5.4	6.5	7.5	12.3	12.4	26.0
208V/3PH	1.9	2.5	2.9	3.4	5.6	7.0	9.0	13.4
230V/3PH	1.6	3.0	2.6	3.7	5.0	6.6	8.6	13.2
480V/3PH	0.8	1.5	1.3	2.0	2.8	3.5	4.3	6.6
575V/3PH	—	0.9	1.0	1.4	2.0	2.6	3.6	5.4
Optional Belt-Drive TEFC Motor								
208V/1PH	2.3	3.5	5.4	6.2	9.5	—	—	—
230V/1PH	2.4	3.6	5.5	6.0	8.2	8.3	15.0	20.2
208V/3PH	1.2	2.3	2.0	3.3	4.8	6.1	7.7	12.6
230V/3PH	1.2	2.0	2.2	3.1	4.6	5.6	7.0	11.4
480V/3PH	0.6	1.0	1.1	1.6	2.3	2.8	3.5	5.7
575V/3PH	—	0.7	0.8	1.4	1.7	2.2	2.9	4.7

Ductstat Adjustment (Two-Stage, Makeup Air, Option AG3)

- The ductstat with attached capillary tube senses the discharge air temperature and operates the two stage valve to maintain the temperature within a fixed differential of 2-1/2°F. Adjustable factory setting is 70°F.
- Due to different CFM settings and outside air temperatures, the average downstream outlet temperature may not match the ductstat setting exactly. After the installation is complete, adjust the setpoint of the ductstat to achieve the desired average outlet air temperature.

Measure and Adjust Manifold (Outlet) Gas Pressure

NOTE: Measuring manifold gas pressure cannot be done until the heater is in operation.

- **For natural gas:** When the heater leaves the factory, the combination gas valve is set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is regulated to 3.5 IN WC. Low fire on a two-stage valve is set to 0.9 IN WC. Inlet supply pressure to the valve must be a minimum of 5 IN WC or as noted on the rating plate and a maximum of 14 IN WC.

NOTE: Always check the rating plate for minimum gas supply pressure.

- **For propane gas:** When the heater leaves the factory, the combination gas valve is set so that the outlet gas pressure of a single-stage valve or high fire of a two-stage valve is regulated to 10 IN WC. Low fire on a two-stage valve is set to 3.8 IN WC. Inlet pressure to the valve must be a minimum of 11 IN WC and a maximum of 14 IN WC.

⚠ WARNING ⚠

- **Manifold gas pressure must never exceed 3.5 IN WC for natural gas or 10 IN WC for propane gas.**
- **Before attempting to measure or adjust manifold gas pressure, the inlet (supply) pressure must be within the specified range for the gas being used, both when the heater is in operation and when it is on standby. Incorrect inlet pressure could cause excessive manifold gas pressure immediately or at some future time. If natural gas supply pressure is too low, contact your gas supplier.**

NOTE: A manometer (fluid-filled gauge) is recommended rather than a spring-type gauge due to the difficulty of maintaining calibration of a spring-type gauge.

1. With the manual valve (on the combination gas valve) positioned to prevent flow to the main burners, connect a manometer to the 1/8-inch pipe outlet pressure tap in the valve.
2. Open the valve and operate the heater. Measure the gas pressure to the manifold. To measure the low-stage pressure on units equipped with a two-stage valve, disconnect the wire from the HI terminal on the valve. Be sure to reconnect the wire.

⚠ CAUTION ⚠

DO NOT bottom out the gas valve regulator screw. This can result in excessive overfire and heat exchanger failure due to unregulated manifold pressure.

3. Normally, adjustments to the factory-preset regulator should not be necessary. If adjustment is necessary, set pressure to correct settings by turning the regulator screw IN (clockwise) to increase pressure or OUT (counterclockwise) to decrease pressure.

Measure and Adjust Manifold (Outlet) Gas Pressure—Continued

High Elevation (>2,000 Feet/609 Meters) Installations

NOTES:

- **High elevation (>2,000 feet/609 meters) application with this unit depends on the installation elevation and the heating value of the gas. At high elevations, the heating value of natural gas is always lower than the heating value at sea level.**
- **Deration is necessary to compensate for low atmospheric pressure at high elevations. Generally this will require obtaining the gas heating value from the local gas utility and replacing the burner orifices.**

For high elevation (>2,000 feet/609 meters) installations that require orifice replacement, replace the burner orifices as follows:

1. Determine model number and rated input (BTUh) from unit's rating plate.
2. Determine appropriate orifice replacement (refer to **Table 22**) for installation elevation.
3. Unthread existing gas orifices from gas manifold.

⚠ DANGER ⚠

- **Do not use Teflon tape or pipe joint compound on the orifice threads. The hole in the orifice may become blocked and may cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.**
- **Use only using factory-supplied orifices. Do not attempt to drill out orifices in the field. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury, or death.**

4. Thread replacement gas orifices into gas manifold. To prevent cross-threading, hand-tighten orifices into gas manifold until snug and then tighten one-half to one turn using wrench.

⚠ DANGER ⚠

DO NOT use an open flame to check for gas leaks.

5. Check all connections for gas leaks using commercial leak-detecting fluid or rich soap and water solution. Leaks are indicated by presence of bubbles. If leak is detected, tighten connection. If leak cannot be stopped by tightening connection, replace part(s).

Conversion to LP (Propane)

⚠ DANGER ⚠

Conversion to LP (propane) gas must be performed by qualified service personnel using a factory-supplied conversion kit. Failure to use the proper conversion kit can cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.

If LP (propane) conversion is required, convert the unit in accordance with form ***CAUA-GC*** listed in **Table 1**. When conversion is complete, verify that the input rate is correct.

Table 22. High Elevation Burner Orifices						
Installation Altitude (Feet)	Installation Location	Unit Size	Natural Gas		Propane	
			PN	Orifice Size	PN	Orifice Size
2001–3000	US	150	84853	#47	97359	1.25 mm
		200	38678	#45	11830	#55
		250			97359	1.25 mm
		300			11830	#55
		350	45870	#38	11834	#54
		400	45871	#39	9789	#53
2001–4500	Canada	150	40414	#48	63003	1.20 mm
		200	38678	#45	11830	#55
		250			63003	1.20 mm
		300			11830	#55
		350	45871	#39	11834	#54
		400	11792	#41	61652	1.45 mm
3001–4000	US	150	84853	#47	63003	1.20 mm
		200	38678	#45	11830	#55
		250			63003	1.20 mm
		300			11830	#55
		350	45871	#39	11834	#54
		400	87391	#40	9789	#53
4001–5000	US	150	40414	#48	63003	1.20 mm
		200	38678	#45	11830	#55
		250			63003	1.20 mm
		300			11830	#55
		350	45871	#39	11834	#54
		400	11792	#41	61652	1.45 mm
5001–6000	US	150	40414	#48	63003	1.20 mm
		200	16590	#46	39658	#56
		250			63003	1.20 mm
		300			39658	#56
		350	87391	#40	11834	#54
		400	11792	#41	61652	1.45 mm
6001–7000	US	150	40414	#48	39658	#56
		200	84583	#47		
		250				
		300				
		350	11792	#41	11834	#54
		400	84437	#42	61652	1.45 mm
7001–8000	US	150	39651	#49	63922	1.15 mm
		200	84583	#47	39658	#56
		250			63922	1.15 mm
		300			39658	#56
		350	84437	#42	11834	#54
		400				
8001–9000	US	150	39651	#49	63922	1.15 mm
		200	40414	#48	39658	#56
		250			63922	1.15 mm
		300			39658	#56
		350	84437	#42	11830	#55
		400	11828	#43	11834	#54

Dirty Filter Switch Adjustment

After the unit is started but before continuous operation, the dirty filter switch must be set as follows:

1. With clean filters in place, blower doors closed (except electrical compartment), and blower operating, decrease pressure setting by adjusting setscrew on switch (see **Figure 29**) clockwise until indicator light is energized or setscrew is bottomed out.
2. At that point, adjust setscrew three full turns counterclockwise or until setscrew is top-ended.
3. At that setpoint, indicator light will be activated at approximately 50% filter blockage.

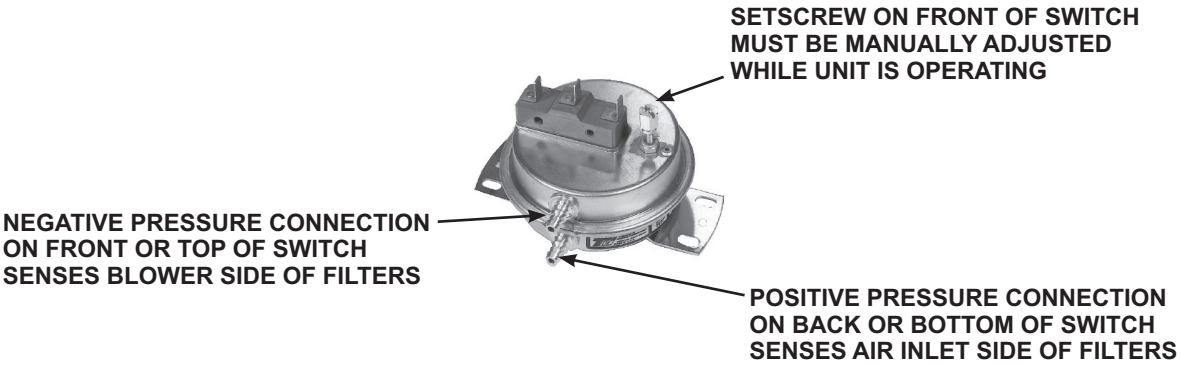


Figure 29. Dirty Filter Switch

MAINTENANCE

⚠ WARNING ⚠

If you turn OFF the power supply, turn OFF the gas.

NOTE: Use only factory-authorized replacement parts.

This unit will operate with a minimum of maintenance. To ensure long life and satisfactory performance, a heater that is operated under normal conditions should be inspected and cleaned at the start of each heating season. If the heater is operating in an area where an unusual amount of dust, soot, or other impurities are present in the air, more frequent maintenance is recommended. If the system includes a cooling coil, the coil and condensate drains should be checked at the beginning of the cooling season.

Service Checklist

The following section is designed to aid a qualified service person in maintaining and servicing this equipment. At a minimum, perform the following annually:

- ❑ Check gas valve to ensure that gas flow is being shut off completely
- ❑ Clean heat exchanger both internally and externally
- ❑ Check burners for scale, dust, or lint accumulation and clean as needed
- ❑ Check vent/combustion air system, inspect all joints, and replace any parts that do not appear sound
- ❑ Clean blower and motor and, if equipped with belt drive, check belt
- ❑ Check filters
- ❑ Check ignitor
- ❑ Clean venter
- ❑ If equipped with cooling coil, check drain lines and clean as necessary
- ❑ Check wiring for any damaged wire—replace damaged wiring (refer to **Electrical Connections** section for wiring requirements)

Maintenance Procedures

Vent/Combustion Air System Maintenance

Check vent/combustion air system at least once a year. Inspect all joints, seams, and terminal caps. Clean grills and screens. Replace any defective parts.

Combination Gas Valve Maintenance

⚠ WARNING ⚠

The combination gas valve is the prime safety shutoff. To ensure positive closure, all gas supply lines must be free of dirt or scale before connecting them to the unit.

The valve has no field-repairable parts. Remove external dirt accumulation and check wiring connections. The combination gas valve must be checked annually as follows to ensure that the valve is completely shutting off gas flow.

a. Locate 1/8-inch FPT INLET pressure tap on combination gas valve (see **Figure 30**).

NOTE: A manometer (fluid-filled gauge) with an inches water column scale is recommended.

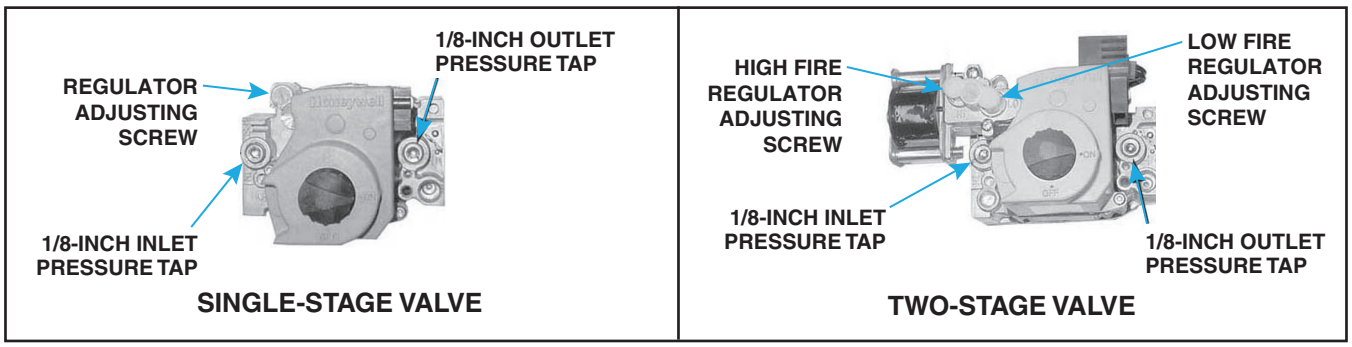


Figure 30. Combination Gas Valve Test Connections

b. With field-installed manual valve closed to prevent flow to gas valve, connect manometer to 1/8-inch FPT INLET pressure tap (see **Figure 30**).

c. With field-installed manual valve closed, turn up thermostat to fire unit and to allow unit to go through one trial for ignition.

d. Reset thermostat to shut OFF unit and observe manometer for 2 to 3 minutes for indication of gas pressure. No pressure should be indicated on manometer. If manometer indicates gas pressure, field-installed manual gas valve must be replaced or repaired before combination gas valve can be checked.

e. If manometer does not indicate gas pressure, slowly open field-installed manual gas valve. After manometer indicates that gas pressure has reached equilibrium, close manual shutoff valve.

NOTE: Refer to Gas Supply Pressure section for operational pressure settings and instructions for checking pressure settings.

f. Observe gas pressure on manometer. There should be no loss of gas pressure. If manometer indicates loss of gas pressure, replace combination gas valve before placing heater in operation.

Maintenance Procedures—Continued

Burner Rack and Manifold Maintenance

⚠ DANGER ⚠

Excessive dirt buildup on and inside the ports on a burner could cause fuel gas to spill out of the back of the burner tube. Fuel gas spilling out of the back of a burner tube will cause gas odor inside the building, and if not corrected, could eventually cause a fire/explosion hazard. To prevent fuel gas spilling from the back of a burner tube, check the burner ports at least annually and clean if necessary.

⚠ WARNING ⚠

To prevent injury, wearing eye protection is recommended.

1. Shut OFF gas supply upstream of combination gas valve.
2. Turn OFF electric supply.
3. Remove burner compartment door.
4. Disconnect union and remove gas pipe from inlet of gas valve.
5. Disconnect wiring:
   a. Mark and disconnect electrical wires to gas valve.
   b. Disconnect flame sensor wire, flame rollout switch wires, and ignitor wire at burner box cover.
   c. Mark and disconnect ignitor ground wire at terminal board.

Burner Rack and Manifold Maintenance—Continued

6. Disconnect silicone tubing from static tap on burner box cover.
7. Remove burner rack and manifold:
   a. Remove all burner cover sections. Depending on when unit was manufactured, there will be either two or three sections. If two, right and left sections extend over front. If three, there will be right, left, and separate front section.
   b. Remove screws (see **Figure 31**) that secure manifold to burner rack. Slide manifold from burner rack.

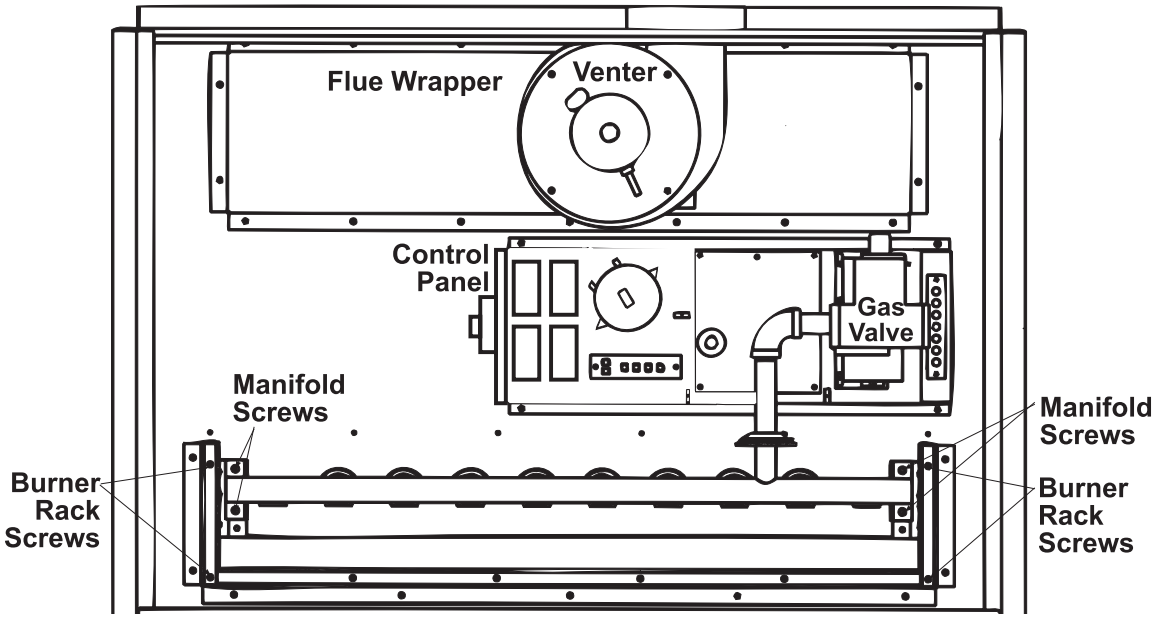


Figure 31. Burner Rack Removal

c. Remove screws (see **Figure 31**) that secure ends of burner rack to cabinet. Carefully pull burner rack away from heater.

8. Clean burner rack and manifold:

NOTE: Requires a wire brush, cleaning cloth, an automotive type aerosol degreaser or refrigerant coil cleaner, and compressed air. Cleaning the burners with an aerosol degreaser is highly recommended as the degreaser will retard future buildup of dirt.

a. Remove any soot deposits from burners using wire brush. Clean ports with aerosol degreaser and/or compressed air. Wipe inside of burner tubes clean.

b. Inspect cleaned burner rack for any damage or deterioration. If burner has any damage or signs of deterioration, replace it.

c. Clean burner orifices with air pressure. Do not ream orifices.

9. Re-assemble heater and test for proper operation.

Cleaning Heat Exchanger

⚠ CAUTION ⚠

Eye protection is recommended.

1. To clean outer surfaces (circulating air side) of heat exchanger, gain access by removing inspection panels in ductwork or removing ductwork. Use brush and/or air hose to remove accumulated dust and grease deposits.
2. Inner surfaces of heat exchanger can be reached for cleaning with burner, turbulators and venter assembly removed. Remove burner rack assembly in accordance with **Burner Rack and Manifold Maintenance** section.
3. Remove turbulators (metal strips inside heat exchanger tubes). Clean inside of tubes using long furnace brush or heavy wire to which steel wool has been attached. Brush inside each heat exchanger tube until all foreign material is removed. A flashlight is helpful in examining inside of tubes.
4. Clean turbulator strips, slide into end of tubes, and re-attach using existing screws.

NOTE: If operating with natural gas, there should be no soot deposits. For operation with propane gas, if sooting exists, check for improper gas manifold pressure and for obstructions in the vent. If the unit is installed as a power vent (drawing combustion air from inside the building) and dirt is found in the tubes indicating a dirty environment, installation of a separated combustion/venting system should be considered.

5. Re-assemble heater and check for proper operation.

Limit Control Maintenance

If it is determined that the limit control needs replacing, use only the factory-authorized replacement part that is designed for the size of heater. The limit control is accessible in the control compartment. The capillary sensor can be reached only by removing the ductwork.

Flame Rollout Switch

If it is determined that the flame rollout switch needs replacing, use only the factory-authorized replacement part that is designed for use on this heater.

Blower and Blower Motor Maintenance

Remove dirt and grease from the motor and the blower. Use care when cleaning to prevent causing misalignment or imbalance. If the unit is equipped with a belt drive, check the belt for signs of wear. Replace if needed. If belt adjustment is required, refer to the **Checking and Adjusting Belt Tension** section. If blower speed adjustment is required, refer to the **Adjusting Blower Speed** section.

Maintenance Procedures—Continued

Filter Maintenance

NOTE: Applies to a heater with either an optional return air filter cabinet, an outside air/return air mixing box with filters, or an inlet base with filters.

Check the filters quarterly. Clean or replace as needed. Refer to the replacement parts manual listed in **Table 1** for replacement filters.

Condensate Drain Maintenance

If the installation has condensate drains (burner, cooling coil, and/or flue wrapper). Clean or replace parts as needed. Fill traps.

Combustion Air Proving Switch Maintenance

⚠ DANGER ⚠

Safe operation requires proper venting flow. Never bypass the combustion air proving switch or attempt to operate the unit without the venter running and proper flow in the vent system. Hazardous conditions could result.

Check the tubing that connects the pressure switch and the venter. If the tubing is blocked or deteriorated, clean or replace. Ensure that the connections are tight. If it is determined that the pressure switch needs replacing, use only the factory-authorized replacement part that is designed for this heater.

Ignition System Maintenance

⚠ CAUTION ⚠

Due to high voltage on the spark wire and electrode, do not touch when energized.

1. Access ignition system in accordance with steps 1-3 in **Burner Rack and Manifold Maintenance** section.
2. Service ignitor:
   a. On right side of burner rack, locate ignitor.
   b. Disconnect wire and remove screw and ignitor.
   c. Clean ignitor assembly using emery cloth.
   d. Spark gap (see **Figure 32**) must be maintained to 1/8 inch.

NOTE: IMPORTANT: When re-assembling, the brown ground wire must remain attached to the ignitor.

3. Service flame sensor:
   a. On left side of burner rack, locate flame sensor.
   b. Disconnect wire and remove screw and flame sensor.
   c. Clean flame sensor using emery cloth.
4. Service ignition control module: integrated ignition control module monitors operation of heater including ignition. Do not attempt to disassemble ignition control module. However, each heating season lead wires should be checked for insulation deterioration and good connections.

NOTE: Proper operation of the direct spark ignition system requires a minimum flame signal of 1.0 microamps as measured by a microampmeter.

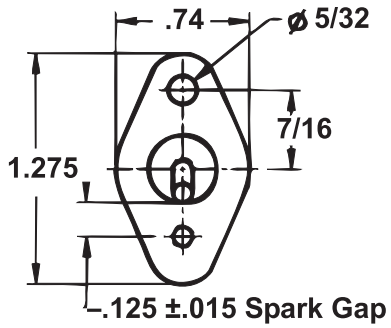


Figure 32. Front View of Ignitor Showing Spark Gap Measurement

Venter Motor and Wheel Maintenance

- Remove dirt and grease from the motor housing. The venter motor is permanently lubricated; do not lubricate. Carefully clean the venter wheel assembly, being cautious not to bend the wheel.
- If it is determined that the venter motor or wheel needs replacing, use only the factory-authorized replacement part that is designed for use on this heater. Follow these instructions for replacement of the venter motor. Keep all removed hardware to be used in re-assembling and installing the replacement parts.
  a. If heater is installed, turn OFF gas and electric power.
  b. Remove control door panel.
  c. Disconnect three venter motor wires at terminal block connections.
  d. While holding motor, remove three or four screws that secure venter motor mounting plate to venter housing. Remove motor and wheel assembly from heater.
  e. Disassemble motor and wheel assembly (see **Figure 33**, DETAIL A):
     (1) Using hex allen wrench, loosen venter wheel setscrew and slide venter wheel off shaft.
     (2) Remove four nuts that secure motor mounting plate and remove mounting plate.
     (3) Each bolt has cylindrical spacer. Remove four spacers and remove support ring.
     (4) Loosen setscrew and remove small fan blade.
  f. Re-assemble with replacement venter motor:
     (1) Check motor mounting plate gasket and replace if deteriorated or torn.
     (2) With blade side closest to motor (hub away from motor), slide small fan blade onto shaft. Position blade so that it does not hit motor and tighten setscrew to flat side of motor shaft.
     (3) Install spacer over each bolt and slide motor support ring over all bolts. Position mounting plate with gasket side away from motor and secure plate using nuts (hand-tighten using nut driver—do not use power tool).
     (4) Rotate fan to check for clearance. If required, loosen setscrew and adjust position of fan blade.
     (5) Slide venter wheel over end of shaft with closed side toward motor. Position wheel with spacing shown in **Figure 33**, DETAIL B and tighten setscrew to flat side of motor shaft.
     (6) Check for proper balance. If wheel is damaged or does not turn properly, replace it.
  g. Install assembled venter motor and wheel. Follow wiring diagram to connect venter wires.
  h. Close access panel.

Maintenance Procedures—Continued

Venter Motor and Wheel Maintenance—Continued

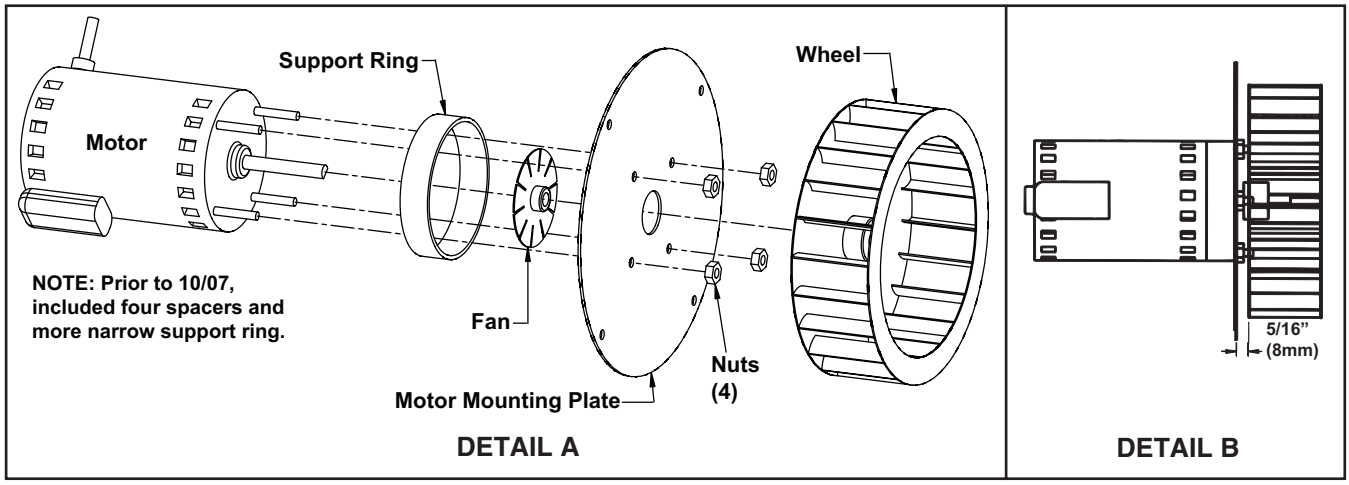


Figure 33. Venter Motor and Wheel Assembly

Transformer Maintenance

⚠ CAUTION ⚠

IMPORTANT: Do not short the hot side of the transformer to ground when servicing the heater. Doing so will cause the transformer to fail.

- **Transformer check (requires a voltmeter):** To verify the 24V circuit, check the operation of the transformer. Set the thermostat to above room temperature. Using a voltmeter, check the voltage between terminal R on the thermostat terminal strip and the ground terminal on the ignition controller. If there is no voltage in this circuit, the transformer is not functioning. The service of a transformer is like that of a light bulb; it is either good or bad and when bad, it must be replaced.
- If replacement of the transformer is necessary, do not substitute any other transformer. Use replacement transformer IDENTICAL to the factory-installed models.

Blower Compartment Door Switch Maintenance

If it is determined that the blower compartment door switch needs replacing, use only the factory-authorized replacement part that is designed for use on this heater.

Ductstat Maintenance (Two-Stage, Makeup Air, Option AG3)

If the ductstat does not operate properly, replace with an identical control.

Inlet Air Damper Maintenance

Clean dampers and controls of dust or dirt.

Two-Position Damper Motor Maintenance

There is no service required on this motor other than external cleaning. If the motor requires replacement, replace with an identical damper motor or damper motor replacement kit.

Modulating Damper Motor Maintenance

There is no service required on this motor other than external cleaning. If the motor requires replacement, replace with an identical damper motor.

Modulating Damper Motor with Logic Module Maintenance

There is no service required other than external cleaning. If the motor or module requires replacement, replace with identical parts.

Potentiometer Maintenence

If the potentiometer requires replacement, replace it with an identical switch.

Return Air Controller Maintenence

If the controller requires replacement, replace it with an identical control.

Mixed Air Controller Maintenence

If the controller does not function properly, replace it with an identical control.

Enthalpy Sensor for Two-Position Control Maintenence

If the controller does not function properly, replace it with an identical control.

Enthalpy Sensors for Modulating Control Maintenence

If the controls do not function properly, replace with an identical control.

TROUBLESHOOTING

General Troubleshooting

NOTE: Do not attempt to repair ignition control module; it has no field replaceable components.

Table 23. General Troubleshooting

Symptom	Probable Cause	Remedy
A. Venter motor will not start	1. No power to unit	Turn ON power and check supply fuses or circuit breaker
	2. No 24V power to venter relay	Turn up thermostat and check control transformer output
		Ensure that all wire connections are solid
	3. Defective ignition control module	If 24V is available to ignition control module, replace module
	4. Defective venter motor	Replace venter motor
B. Burners will not light	1. Manual valve not open	Open manual valve
	2. Air in gas line	Bleed gas line
	3. Door switch open	Close blower compartment door; if door is closed, replace switch
	4. Gas pressure too high or too low	Adjust gas pressure (refer to **Measure and Adjust Manifold (Outlet) Gas Pressure** section)
	5. No spark	
	a. Loose wire connections	Ensure that all wire connections are solid
	b. Transformer failure	Ensure that 24V power is available
	c. Incorrect spark gap	Maintain spark gap at 1/8 inch
	d. Spark cable shorted to ground	Replace worn or grounded spark cable
	e. Spark electrode shorted to ground	Replace ceramic spark electrode if it is cracked or grounded
	f. Burners not grounded	Ensure that ignition control module is grounded to ignitor
	g. Ignition control module not grounded	Ensure that ignition control is grounded to furnace chassis
	h. Defective ignition control module	If 24V is available to ignition control module, replace module
	6. Lockout device interrupting control circuit due to above causes	Reset lockout by interrupting control at thermostat or main power
	7. Defective combustion air proving switch	Replace combustion air proving switch
	8. Main valve not operating	
	a. Defective main valve	If 24V is available to valve connections and valve remains closed, replace valve
	b. Loose wire connections	Ensure that all wire connections are solid
	9. Ignition control module does not power valve	
	a. Loose wire connections	Ensure that all wire connections are solid
	b. Flame sensor grounded	Ensure that flame sensor lead is not grounded or that insulation/ceramic is not cracked; replace as required
	c. Incorrect gas pressure	Adjust gas pressure (refer to **Measure and Adjust Manifold (Outlet) Gas Pressure** section)
	d. Cracked ceramic at sensor	Replace sensor
	10. Flame rollout switch open	
	a. Air blockage through unit	Check for heat exchanger or vent pipe blockage
	b. Defective flame rollout switch	Replace flame rollout switch

General Troubleshooting—Continued

Table 23. General Troubleshooting—Continued

Symptom	Probable Cause	Remedy
C. Burners cycle ON and OFF	1. Gas pressure too high or too low	Adjust gas pressure (refer to **Measure and Adjust Manifold (Outlet) Gas Pressure** section)
	2. Burners not grounded	Ensure that ignition control module is grounded to ignitor
	3. Ignition control module not grounded	Ensure that ignition control is grounded to furnace chassis
	4. Defective ignition control module	If 24V is available to ignition control module, replace module
	5. Defective combustion air proving switch	Replace combustion air proving switch
	6. Flame sensor grounded	Ensure that flame sensor lead is not grounded or that insulation/ceramic is not cracked; replace as required
	7. Cracked ceramic at sensor	Replace sensor
	8. Incorrect polarity	Reverse 115V line connections at ignition control module
D. No heat (heater operating)	1. Incorrect manifold pressure or orifices	Adjust gas pressure (refer to **Measure and Adjust Manifold (Outlet) Gas Pressure** section)
	2. Limit control cycling ON	Check airflow
	3. Improper thermostat location or adjustment	Refer to thermostat manufacturer's instructions
E. Cold air delivered	1. Incorrect manifold pressure	Adjust gas pressure (refer to **Measure and Adjust Manifold (Outlet) Gas Pressure** section)
F. Blower motor will not run	1. Circuit open	Ensure that all wire connections are solid
	2. Defective ignition control module	If 24V is available to ignition control module, replace module
	3. Defective blower motor	Replace blower motor
G. Blower motor turns ON and OFF while burner is operating	1. Motor overload device cycling ON and OFF	Check motor load against motor rating plate
		Replace blower motor as necessary
	2. Three-phase motor rotating in opposite direction	Interchange two legs of supply connection
H. Blower motor cuts out on overload	1. Low or high supply voltage	Correct electric supply
	2. Defective blower motor	Replace blower motor
	3. Static pressure incompatibility	Adjust blower speed or ductwork
	4. Defective bearing	Replace blower motor

Unit Troubleshooting Using Ignition Control Module

The LEDs on the ignition control module (see **Figure 34**) may be used to troubleshoot the unit (refer to **Table 24**). See **Figure 35** for a flowchart for troubleshooting the unit using the ignition control module.

NOTES:

- **Do not attempt to repair the ignition control module. The only field-replaceable component is the 3A type ATC or ATO fuse.**
- **The direct spark integrated circuit board is polarity sensitive. If burners cycle ON and OFF, try switching the power supply leads. The supply connection made to L1 on the circuit board must be the hot wire.**
- **IMPORTANT: When using a multimeter to troubleshoot the 24V circuit, place the meter's test leads into the 5- or 9-pin connector located on the ignition control. Do not remove connectors or terminals from the electrical components. Doing so can result in misinterpreted readings due to the ignition control module's fault mode monitoring circuits.**

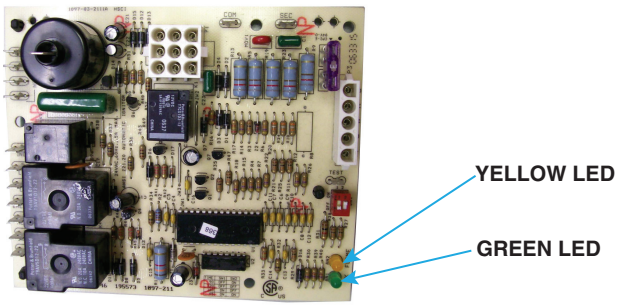


Figure 34. Ignition Control Module

Table 24. Unit Troubleshooting Using Ignition Control Module

LED	LED Status	Indication
Green	Steady	Normal operation—no call for heat
	Fast flash	Normal operation—call for heat
	One flash	System lockout—failed to detect or sustain flame
	Two flashes	Pressure switch did not close within 30 seconds of venter motor
	Three flashes	High limit switch open
	Four flashes	Pressure switch is closed before venter motor is energized
	Steady OFF	Blown fuse, no power, or defective board
Yellow	Steady ON	Flame is sensed
	Slow flash	Weak flame—current below 1.0 (±50%) microamps
	Fast flash	Undesired flame—valve open and no call for heat

Unit Troubleshooting Using Ignition Control Module—Continued

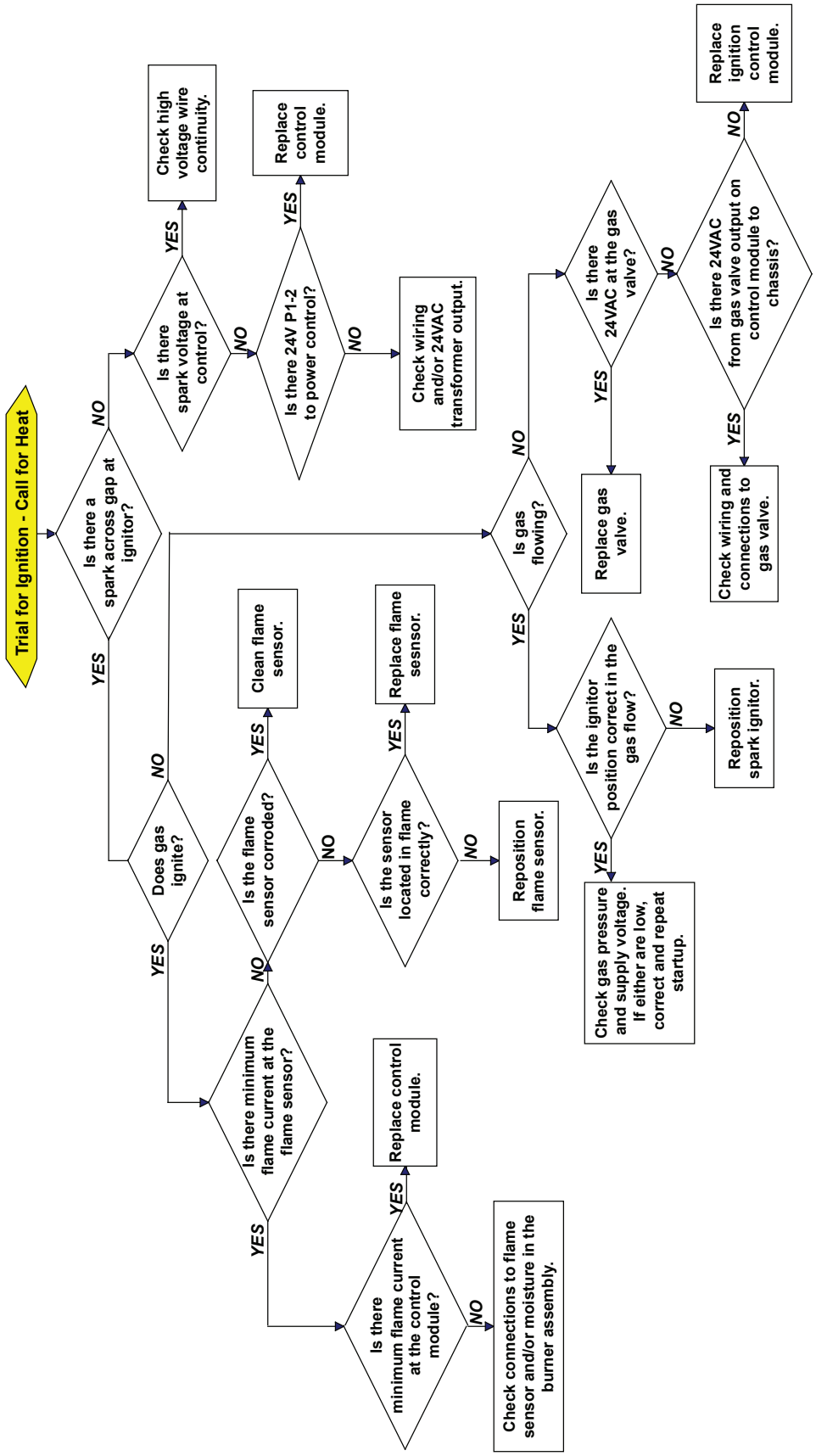


Figure 35. Ignition Control Module Troubleshooting Flowchart

NOTES

INSTALLATION RECORD (TO BE COMPLETED BY INSTALLER)

Installer:

Name _____

Company _____

Address _____

_____

Phone _____

Distributor (company from which the unit was purchased):

Company _____

Contact _____

Address _____

_____

Phone _____

Model _____ **Serial No.**_____ **Date of Installation** _____

Specific installation notes (i.e., location, amps, gas pressure, temperature, voltage, adjustments, warranty, etc.):

_____

_____

_____

BUILDING OWNER OR MAINTENANCE PERSONNEL:

For service or repair:

Contact the Installer listed above.

If you need additional assistance, contact the Distributor listed above.

For more information, contact your Factory Representative.

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